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ORGANI-CULTURE

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GOOSEBERRIES REVITALIZED BY COMPOST AND EARTHWORMS

September 22, 1948.

In the fall of 1942, I planted six gooseberry bushes, all pruned nursery stock, in glacial soil, and used nothing on them but chemical fertilizers. In five years the bushes made a total growth not exceeding one foot, and this was badly infested with insects and unproductive.

In the fall of '47, I dug up the bushes and replanted them in a trench two feet deep and put the topsoil in the bottom. Inasmuch as my compost piles had not completed their bacterial break-down, I had only a small amount of organic fertilizer, so used sweet corn stalks after the corn was picked. Too rushed for time to chop up the stalks, I placed them lengthwise in the trench, using alternate layers of stalks and earth mixed with a little compost, and then mulched with cow manure six inches deep.

When checked this fall, I found the

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growth of bushes so amazing that I got the spade and began digging to see what was going on down there. The little compost I'd used was filled with earthworms, and now I found that the old corn stalks, while still retaining their identity, were tunneled throughout by earthworms. And the uninfested new growth of bushes, which in five years had not totaled a foot, now was three feet by actual measurement. I think that I have sufficient reason to hope for gooseberry pie next season!

Jack Van Clute,
3035 East 195th St.,
Seattle 55, Wash.

—o—

TREES ALSO RESPOND TO COMPOST

August 27, 1948.

My landlady has the poorest soil I have ever come across; extremely alkaline, hard pan near the surface in many places, also mildew and moldy. But in spite of the poor soil condition, I was bound to have a flower garden and a little vegetable garden. So a year ago I started to improve the soil by deep digging, watering and using steer manure, peat moss and mulching.

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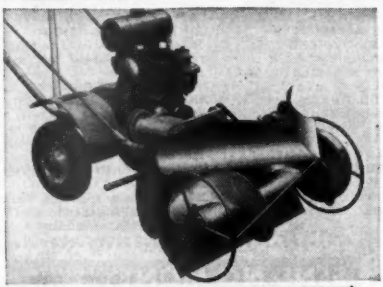

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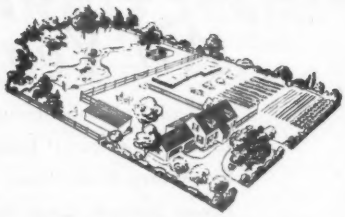

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there are young walnut, fig, and peach trees. They were sickly looking from lack of right care. The peach tree had only a few leaves and they would turn yellow and drop off shortly after leafing out. .

I used the peach tree to shade my shade and semi-shade loving plants, but I had no intention of looking after or taking care of the trees. But being on the plot of ground that I have put in good condition (still needs more improvement), you should see the results.

The walnut tree shows the largest growth of new limbs. The fig tree shows a good new growth and a good crop of figs for such a young tree. And the peach tree is thickly leaved and of a dark green color and healthy looking (no falling yellow leaves now); and it has several big peaches.

The roots of these trees just took advantage of the water, fertilizers and

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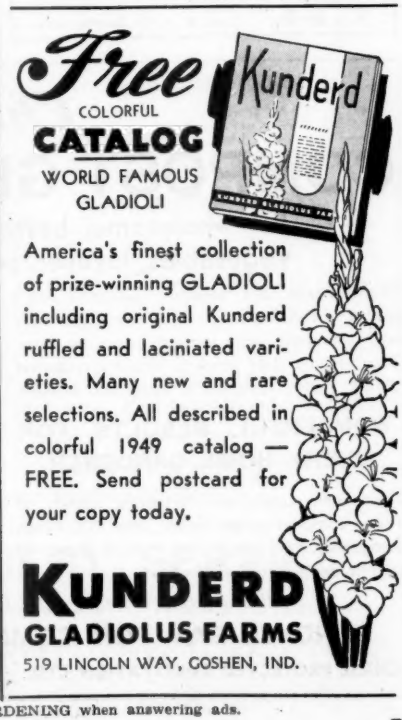
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mulching that was leaching down from my gardens onto their roots.

In fact if the peach tree keeps on improving as it has this summer, by next year it will be too shady for my shade garden. (We'll see.)

I have had good crops of vegetables and flowers. My Pacific Hybrid Delphiniums have not stopped blooming since early May. I was told that they would bloom once in spring, then should be cut back for new blooms in the fall. I certainly hope they won't bloom themselves to death.

Miss Hilda Flack,
202 S. Rose Ave.,
Compton, Calif.

—o—

PRIZE ORANGES

October 18, 1948.

Dear Sir:

A few years ago a committee of orange experts in this country was

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ARTIFICIAL INSEMINATION

IN the organic method of farming, it is not only a matter of making compost, or applying various kinds of organic matter to the soil. It goes further than that. It calls for a study of the phenomena of Nature in order to be in a position to guide ourselves in the practice of agriculture so that we may not depart too far from her methods. The organic farming movement, in spite of the angry criticisms of its opponents, is not a religious cult; it does not require every act of farming or gardening to be parallel with every act of Nature in the field or in the forest. That would not be practical or realistic in a world of huge populations that have to be fed, in a world where *homo sapiens* wishes to dazzle his neighbor with a better automobile, a finer fur coat, in a world where millions crowd into cities where they exist like ants in tiny, constricting, apartment-house cubicles.

We recognize the problem of having to live in a commercialized, mechanistic, industrial world, guided by science, and we must play our part in it in a practical manner. The theme of the age seems to be science, so I say LET US BE SCIENTIFIC. Science does not have to mean only test-tubes manipulated by men in white coats, or the anatomical probing into the atom or scientists dissecting and delving into the carcasses of helpless animals. Science is a search after the correct way. The dictionary says that science is "knowledge, as of general truths or particular facts, obtained and shown to be correct by accurate observation and thinking". So by accurate observation and thinking we can behold the practices of nature and take therefrom what is scientifically most beneficial for the soil and for the people who eat the crops that come from it. Thus organic farming can be more scientific than the present-day conception of scientific farming with its leaning on commercial, highly concentrated fertilizers, with DDT and 2-4-D and a host of other expensive items that, with the return of a normally-priced market for agricultural products, will spell financial difficulties for the farmer. When science took penicillin from the soil, it was taking from Nature. Science was not ashamed to use a device that Nature uses to combat the unruly, bandit elements in the soil's bacteria population. Let us hope they will appropriate other methods of Nature, for the purpose of bringing health to the population, just as Nature insures the health of her plants and animals.

I have wandered afield a bit in order to show that the organic farmer must be scientific. He must observe. He must rotate his crops, he must find other safe adjuncts to compost such as ground-up limestone, phosphate rock and other mild rocks, and possibly basic slag, a by-product of the steel industry. He must still be on the search for other safe fertilizer materials. He must not overcrowd the pastures, he must plant certain crops solely for the purpose of plowing them under as green manure, he must be a good husbandman, knowing the right time to plant and follow all the details of the general cultural practices of the farm so as not to lose the benefit of the compost he applies to his soil. He

must be ever on the alert to examine critically any new practice offered by the agricultural colleges which may be a necessity to them arising out of the evils of their artificial farming methods, which they hail as an epoch-making achievement of science, yet if one examines all the facts underlying these colossal discoveries he will find that they are an outcome of other epoch-making discoveries of the previous decade, whose pernicious repercussions created the need for this new, revolutionary process.

Of one such new scientific farming practice, the artificial insemination of cows, I would like to write, but before doing so, will say a few general words about the production of milk for public consumption. This fluid is secreted by the mammary glands of the cow for the purpose of feeding a calf. Usually a cow should have a calf a year. If a young heifer grows up a spinster she does not give any milk, but when she has a calf the wherewithall is provided to feed it. Nature is quite bountiful. She usually furnishes a substantial reserve, so from time immemorial, the owner of the cow has taken some of the milk unto himself and family. These are simple facts known generally, but there are some people who merely know milk as an opaque white fluid given by a cow. The why or the wherefor of the process they have not learned. So remember, that the milk is a by-product of the cow which is an important part of having a calf. It is a part of its complicated system of reproduction. The supply of milk lasts only until there is no more need for it when the calf has grown and can feed in pasture. Then the milk supply dries up and will not begin to flow again until the cow has another calf.

As the industrial era began to create big city populations the need arose for larger supplies of milk. Therefore it became necessary to slaughter calves at an early age, to be sold in the meat markets as veal, in order that the milk could be saved for the public. (In this respect, I imagine that veal is a much healthier meat than that of an old tired-out cow who has been milked to within an inch of her life. I therefore offer this as a bit of unscientific observation for all it is worth.) The demand for milk seemed to be relentlessly unlimited, ever-increasing, so science came to the rescue. They began to breed cows with the idea of increasing their power to give milk.

This was a more or less simple proposition for trained scientists. They chose cows that had the highest record of milk production and mated them with bulls from similarly high-producing strains, so that with each succeeding generation, the general level of milk production went higher and higher. According to statistics about twenty-five years ago an average good cow gave about 1,500 pounds of milk a year. Today by continual employment of scientific breeding the average production of milk per year has gone up to 4,500 pounds, or an increase of 200 percent in only twenty-five years. The figures do not seem to be available for prior years but it is a known fact that the udders of cows today are ten times the size they were in the time of George Washington. There is a direct relation between size of udder and milk production. A cow cannot frolic much, and be contented and have to carry around those huge milk-bags. Where has the Society for the Prevention of Cruelty to Animals been all these years while this cruel process has been going on? Is it time to form a new association to protect the cow and her liberties? I like the way the staid Encyclopedia Brittanica sympathizes with Bossy. It refers to her as "A gentle, amiable, ever-yielding creature who has no joy in her family affairs which she does not share with man. We rob her of her children that we may rob her of her milk." We do not have a cow on our farm but if we ever get one it will be of a scrub variety that gives the least amount of milk. There are varieties of beef-producing cows whose milk production is low because they have been bred to produce the most meat and are not used too much to break milk-yield records. For a health-conscious person, those are the breeds to

have. If our Soil and Health Foundation ever collects enough money to purchase the necessary equipment, we will test the nutritional content of milk produced from high and low yielding cows.

Now comes this new practice called artificial insemination by which there is no more contact between bull and cow. The semen is obtained by artificial methods from a bull and applied via test-tube to the cow. As it is, the cow today is a highly artificial creature, made so by the unnatural methods of science, but when to this is added this monstrous, brutal, stupid insemination procedure, God only knows what the ultimate consequences are going to be. How brave and reckless are the dairy scientists! Cato, the elder did not realize how he was helping me to write this editorial when he said, "There is a wide difference between true courage and a mere contempt of life." For that exactly covers the situation. The calf and its milk should be brought forth by a natural process, because the milk, being a by-product of the reproductory process is closely tied in with many glands of the body, and with the production of hormones. For babies who need milk nothing is too good. They require a good start in life. But in the greed for dollars they do not seem to think of babies. And how about the health of older people who drink milk produced from a spurious process? We, a scientific nation that produced the atom bomb, sit smugly by while the dairy people palm off on us a process which has not been tested.

I wrote to many state colleges and one of them wrote back:

"We have your letter concerning the experiment we are carrying on in the nutrition of dairy cattle. Frankly, this experiment is really getting just well under way. It takes a long time in an experiment of this nature to get results in which you have any confidence. There is actually not too large a herd of cattle to deal with and that introduces troubles concerning individuality of animals and obtaining of heifer calves to put back into the experiment. We believe the experiment is well organized and is progressing and will give us some very valuable information. As yet, however, there are no findings which we would feel at liberty to report. It is our idea that an experiment should continue at least ten years so as to involve several generations of cattle."

This man believes ten years of experimenting would prove the answer one way or the other. Possibly. Perhaps twenty years would be safer. The medical profession is unusually strict about accepting generally a curative procedure before it is thoroughly tested. Yet today artificial insemination of cows, an agricultural medical procedure, has been recklessly adopted without waiting for laboratory testing. It is being used today in every dairy state in the United States. I have been informed that 3% of all the cows in this country are now part of this program and the number is increasing rapidly. I feel certain it is going to lead to trouble. I recall an experiment that was made in a medical college with mice, the exact details of which I cannot recollect. But I do know that a certain negative condition was brought about in their diet for some reason. They went along from generation to generation, in the best of health until they reached the sixth generation and even at that time they were apparently in good health. Then something happened. They became sterile. They could not have young.

I have recently come across an item in the New York Times that gives a premonition of what we may expect in artificial insemination. Leon Hale, farm editor of the Houston (Texas) Post is quoted as saying: "You might think about trying to do something about these bull calves. All the dairy cows down here have taken to having bull calves, and if the Government doesn't do something about it, where is the milk coming from four or five years from now?" Isn't it possible that Nature will take a hand, so that the milk scientists will breed their cows right out of the picture? It is as if Nature is talking to them and say-

ing, "Unless you can have the cow give the kind and quantity of milk she was intended for, I will see to it that no more females will be born, and then where will you be, drink Coca Cola, I suppose?" Nature can be tragic and humorous. We know that in the past Nature has acted mysteriously uncanny. There are waves of rhythm in births, sometimes more males, sometimes more females being born. After bloody wars Nature of her own accord has been known to correct the deficiency by increasing female births. She keeps a general overall equilibrium. But she *has* that weapon and it will be interesting to watch that aspect of the situation. Will readers check this in their own states?

A clipping sent to me from *The Canadian Countryman*, dated Sept. 4, 1948 is of pertinent interest. It seems that the dairy cattle in Waterloo County, Ontario, are having reproductive troubles, so a survey is being initiated to discover the cause. The paper goes on to say, "This survey was initiated as a result of reproductive troubles experienced in herds where cows were being *bred artificially* to the select sires owned by the County breeders' club. These reproductive troubles were particularly evident on certain farms and for no apparent reason, such as infectious disease. It was finally decided to test the soil on these farms for humus content, since humus is the key to all fertility.... The humus tests not only showed that organic matter was low on most cultivated land but provided a cue as to how this can be corrected.... Breeding troubles were especially plentiful on one rolling farm where erosion was much in evidence.... The farmers in this county are among the largest purchasers of commercial fertilizers in Ontario." And they discovered that where certain practices were carried on which enriched the soil with organic matter there was less or no reproductive troubles in dairy cattle. There you have it—artificial fertilizers *and* artificial insemination, and it will surely lead to artificial people.

Let me close by quoting a little item entitled "Scientific Butter" that I came across in a newspaper. This no doubt will be the way the butter of the future may have to be made:

"Scientists predict a great future for synthetic butter made from coal. The process involves reducing coal to coke which in turn is converted into gas which is converted into paraffin which is converted into fatty acids which are in turn refined, and finally the butter is produced." It seems to us these scientists have never heard of a cow.

J. I. RODALE.

ARTIFICIAL INSEMINATION

By SIR ALBERT HOWARD, C. I. E.

A Letter to the *New English Weekly*

I SHOULD like to offer a suggestion by which a definite conclusion can be reached on the value of artificial insemination in live stock—a matter introduced in your issue of June 28th under the title "The Genetic Revolution". My suggestion is based on some thirty years' experience in actual plant breeding, which included a long period devoted to a study of the methods by which fertilization is brought about. Briefly stated, I found it did not pay to interfere with the methods of pollination laid down by Nature. As long as the investigator worked within the limits imposed by natural law, all went well, but the moment any attempt was made to work outside these laws trouble invariably followed. I will quote one ex-

ample. The flowers of the cotton plant are pollinated in two ways—by pollen from the same plant and by pollen from other plants. Both self- and cross-pollination are the rule in this crop. But, if we prevent cross-pollination altogether and only allow self-pollination, a falling off in vigour becomes noticeable after some five or six years—the first signs of loss of reproductive power begin to show themselves.

In the artificial insemination of animals, the interference in natural law is as great, if not greater than in the self-fertilization of the cotton plant for reasons which need no explanation. Before artificial insemination was released from the shelter of the experiment stations a long-term trial should have been carried out. Two herds of the same breed should have been maintained side by side under similar conditions. One herd should have been bred by natural means, the other by means of artificial insemination on both sides—male and female. In some ten to twenty generations I am convinced that interesting differences would develop. The animals raised by artificial insemination would begin to show definite signs of loss of reproductive power. The practice of artificial insemination would then be relegated to the scrap heap: the investigators would have been taught the limits of their powers: the vigour of our live stock would have been preserved.

But nowhere can I find any evidence that such a common-sense test has been carried out, so that Nature herself could give a clear-cut verdict. Instead, all sorts of arguments have been advanced in support of this monstrous innovation for the most part based on considerations of profit. But if, as is more than likely, this practice leads to species-erosion, these ephemeral profits will soon become a total loss.

The authorities concerned have, in my judgment, failed in their duty to safeguard our breeds of cattle. These breeds are a precious inheritance: they have been built up by the labours of many generations of farmers: the husbandmen of today may, of course, use them, but they are only trustees: they must, in duty bound, hand these breeds on to the next generation in at least as good a condition as they found them. If they fail in this duty, they are guilty of a serious breach of trust.

This principle of trusteeship applies to many other aspects of crop production and animal husbandry. It concerns the owners of land, the men who farm it, the land workers, and the urban population whose food is all produced by the earth's green carpet. Once this idea of trusteeship is welded into the make-up of every boy and every girl in our schools, and then woven into public opinion, the place of the farm and the garden and of our food supplies in our future affairs will need no argument. This task, of course, involves the relegation of the profit motive from the position of a short-sighted master into that of a useful servant. This is the great task now before us.

ARTIFICIAL INSEMINATION

By An Anonymous Englishman

THE husbandman, as stock-breeder, has to decide whether, or how, he will use the method of Artificial Insemination which is offered him by the experimental biologist. This raises, in an extreme form, the perennial problem of 'the proper administration of the subhuman world' with which the arts of husbandry are specially concerned. It is not easy to fix a point dogmatically, on theological grounds, which will distinguish illegitimate from legitimate 'interference' with nature by man as husbandman. We

submit, however, that the following considerations should rule (or even rule out) the adoption of Artificial Insemination in the present state of our knowledge.

1. *Man certainly must 'interfere' with nature.* As husbandman he works on 'nature's bounty' and must do so if he is to order the natural world to his own requirements. No one objects to the thinning of a row of onions or the pruning of an apple tree. It may be said that nature, to be truly faithful, needs man's services as husbandman. Nature maintains, of course, her own ecological balance and her own life. But the enormous over-plus in nature's bounty has to be regulated and controlled if the whole is not to come to waste. In such activity man is nature's priest. He is the servant of the natural order. But this never gives him licence to be its exploiter.

2. *But what is the effect of man's right to interfere with the natural processes in farming?* The general principle is that he has a right to co-operate with, but not to fight, nature. This means that where he can assist natural processes to achieve his object more certainly and more rapidly, for the benefit of human life, than would happen through natural processes alone, then he is at liberty to do so. But in any such case it is his duty to take care that he is not overlooking any circumstances, or neglecting any probable if uncertain factors, which might in effect put him in the position of fighting nature. One can only expand this idea by a practical example.

Let us take the new insecticide D.D.T. This preparation has the capacity to kill all insect life by contact with anything that has been sprayed with it, but we know of no harmful effects when man himself touches it. At present a great experiment is being undertaken with this insecticide. The American soldiers' clothes are being impregnated with D.D.T. in the Far Eastern campaign in order to prevent them from getting any form of lice or other parasites. If, after three years of its use, no harmful effect can be observed, it is probable, though not certain that it has no effect on the human epidermis. In this case there must be a note of caution until much more is discovered about it; but if used to impregnate the wall of a dairy it should be wholly beneficial by killing all flies. This would remove a source of infection from such a breeding medium as milk, which was meant to have little or no contact with the atmosphere, since in nature it goes straight from teat to calf. However, for thousands of years milk has been an important food for human beings and it is obvious that nature can be helped to preserve, as it were, a pure life-line between the udder and the consumer if we can eliminate a cause of infection in this natural product which has to be used unnaturally.

D.D.T. is also recommended as an insecticide to prevent the attack of aphis and insect on plants and trees. Here, however, it is used rather to fight nature than to help, for it kills not only the harmful aphis and insect, but the beneficial, and disturbs the harmonious balance of nature. Insight into this 'balance' of natural life, with constant study of it, and reluctance to disturb it more than is unavoidable for the right end in view, is characteristic of all good husbandry.

3. *The over-plus of nature.* Right husbandry is, in one aspect, the regulation and utilization of the superabundance of nature, which, however, can be rendered sterile by abuse or inept interference. Nature, left to herself, uses her wastefulness for two purposes: (a) to support the harmonious relationship between varying forms of life, and (b) to cure diseased conditions.

In (a) man can consciously use nature's wastefulness for his own purposes, i.e. if an ear of wheat produces 80 grains he can use 72 to feed himself and keep 8 to replant for seed. If a cow will naturally produce 500 gallons of milk and only needs 200 gallons for her calf, he can utilize the extra 300 gallons. But he must appropriate these profits by methods very carefully adapted to avoid any detriment either to immediate reproduction or to future

generations of plant and animal. If, for instance, having found that certain types of wheat can produce more than 80 grains to the ear, he breeds from these, disregarding other qualities in the wheat, he may find that while he gets very much bigger yields, he has sacrificed either the nutritional value of the wheat, or the stamina of the plant and the later harvests will be worse than the former. It is unnecessary here to mention the further harm he can do by separating out the different qualities of food, or by the milling for white flour. If man is going to try to increase his yields, he must be very certain that he is not doing it at the expense of nutritive value in the product or the stamina of the plant itself. He must also remember that each increase of yield exacts from him the same additional amount of attention to the restoring of the soil, which is the foundation of life, the organic condition upon which the continuance of increased yields is possible. Neither in animal or plant can yields be permanently heightened by breeding or by any other isolated development of method. The husbandman has continually to balance many considerations with a view to the whole, and dare not concentrate only on the immediately profitable part. He has to work within nature's plan and not use merely what suits his ephemeral purpose.

With regard to (b) the cure of diseased conditions, the husbandman should use disease as a clinical thermometer to tell him when the organism is out of harmony. The mere destruction of a symptom may do nothing to cure a disease, but may drive it to other manifestations which will be found to be related, though they have no apparent connection. Conversely to stimulate and over-develop one symptom of health may undermine the constitution of an organism. At Kew there are certain classes of rare orchids which can be made to flower with far more vigour, profusion, and perfection by the addition of chemical fertilizers in the right proportion than they would otherwise do. The seeming health of these orchids is outstanding; but, in the following year, these normally long-lived plants die—they have been forced out of the natural order. This is a case where cause and effect are easily apparent; but in most of our dealings with nature their connection is not so easy to trace.

In the breeding of animals, we have to scrutinize methods even more cautiously than in breeding plants, for the animal organism stands higher in the scale of life. Moreover, the greater amount of economic capital involved is more likely to lead us into temptation, and if we take a wrong path, it is usually more difficult to abandon it and start again. Let us say that, with average farming methods, it takes two acres of average land to keep a cow in bodily health and in full breeding capacity throughout the year. Over and above that, if we want to get her milk, it is economically desirable to force the yield as high as possible, since it reduces the overhead cost. But we cannot, therefore, ignore the effect this is likely to have on the quality of the milk, the health of the cow, and the stamina of future generations. There are two methods of obtaining increased yield, one environmental and the other genetic. We can, for instance, feed the cow with large quantities of concentrated foods to obtain our yield. This indeed is necessary if we are going to prevent her from giving her yield at the expense of her own bodily structure; but in feeding her at this rate on unnaturally concentrated foodstuffs we are making additional demands on her digestion, which may well affect the unborn calf within her and is more than likely to affect her own longevity as a continuous producer. In other words, we must cooperate with nature by giving her food which is within the capacity of her digestion and suitable to it. If we go beyond this, we are fighting nature to merely temporary advantage.

Secondly, we can raise the yield by applying a genetic method. It is the cow's constitutional or inherited capacity to produce milk which matters most to the farmer, once he has mas-

tered the elements of sound feeding, and it is chiefly with this in mind that he comes to the question of breeding. Here we get to the crux of the whole problem of breeding and the challenge of Artificial Insemination. Certain breeds of cattle can produce great yields of milk, which are low in the right balance of fats and solids; here quantity has been sacrificed to quality. In other cases such quality as can be attested by analysis is maintained together with a high quantitive yield. But the breeds most marked for their milk-yielding capacities are also the breeds where degeneracy and deterioration are most naturally observable. Bulls come to look more and more like cows: diseases such as sterility and abortion are more marked among them. According to some experienced opinion, which has not been contradicted by any systematic observations, perversion is more widespread among these animals than among wild cattle, or less highly developed breeds.

Such effects should not surprise us. In breeding with the sole aim of a higher milk-yield, we are breeding to increase a purely feminine characteristic and secondly, we are trying to develop in the females one portion of the sexual cycle, i.e. lactation, without regard to other procreative qualities. Once again one comes back to the need to co-operate with nature by breeding from an all-round point of view and to select milk-producing potentialities only as one of a series of naturally desirable qualities in the animal.

Artificial insemination increases the temptation of the breeder to concentrate only on one quality among many which are desirable, e.g. the economic one of milk production. In America, where the method is being extensively employed, we are informed that nearly everything is sacrificed to this one quality, with what results we may only be able to find out in the course of the next fifty years.

Can Artificial Insemination be justified as in principle only an extension of the long-accepted practice of castration? This was suggested by one of the veterinary experts who assisted us and was duly considered. Castration as a method in stock-breeding may be defended as only an application to animal breeding of the principle of 'pruning', which is indispensable in certain spheres of plant culture. In the polygamous breeds of animals, Nature herself may be said to employ the equivalent of castration, since the weaker males are disqualified in the sexual selection. The master bull or ram, or the victorious cock in the poultry yard, is the only inseminator of herd or flock whilst his vigour lasts. (We could not, for instance, castrate swans, which mate for life, without losing the progeny altogether). In castration, therefore, we are in effect replacing nature's method of sexual selection by combat by a method of our own, calculated to perpetuate and develop in the progeny certain qualities other than that of combative efficiency, which we think more desirable.

Thus castration is an interference with the economy of nature, which preserves the surplus males for human use as food, but it does not constitute an interference with the procreative function. It is in this sense that Artificial Insemination is, in our view, wholly different in principle and is indeed a complete innovation. It is not merely an interference in a vital function. A naturally indispensable function is eliminated altogether and its place supplied by the veterinary expert with his instruments. Moreover, it is from the animals that are deprived of this function that their successors are bred.

If this practice were extended to a point at which it had become an important factor in the ancestry of most of our live stock, there would presumably be cumulative effects, which are at present quite incalculable. We know very little indeed as to the importance of the function it is proposed to regard as purely optional. We do not know what, if any, dynamic and nutritive forces may be conveyed in the ejaculatory fluid, or whether its reduction to the minute quantities used in artificial insemination is bio-

logically sound. We do know that, in the human body, the period of intensive courtship is of great importance in altering the glandular balance and general harmony of the body, and, brief though the female's period of courtship may be in animals, we have no right or reason to disregard its biological value. The balance and interaction of the vital functions in living creatures are continually revealing new and unsuspected harmonies; as we have seen, e.g., in the enzyme which is generated in the crops of sitting doves, but which does not appear if the eggs are infertile. There are hints, such as this, that the sexual act may play a larger role in the total life of the creature than we can fathom, and that its suspension or abolition must have large consequences we cannot foresee.

These considerations seem to us more than cautionary. Opposing them, or minimizing their relevance, one of the experts consulted said that the part of the cow in the sexual act was purely mechanical; but we are quite unable to admit that any function of a living animal is of that character only. Our general conclusion is that the effect of artificial insemination upon herds is practically certain to be degenerative. Upon short-term calculations it may economize exertions and yield some profits, but upon a larger view it will create problems involving more trouble and expense than it will save. As to its use as an emergency measure, for the replenishment of the live stock of war-stricken Europe, this argument has been put forward in the press; but the experts we consulted did not believe that this problem of re-stocking could be much accelerated by artificial insemination.

We have also considered the effect of this practice upon husbandry itself. The danger here is that it will tend to turn the husbandman into an agricultural producer. In other words, its effect will be to mechanize an art. The use of tractors is already to some extent responsible for divorcing man from his feeling for the soil, and its influence in this direction can only be prevented by the most conscious efforts and strict self-discipline on the farmer's part. If breeding could be made as easy and mechanical as the tractor makes cultivation, the ordinary husbandman may well begin to lose his sureness of touch with, and comprehension of, animal life. Somebody else takes the trouble for him and all that he has to do is to rear any animals so produced. In due time he will begin to lose knowledge of the visible processes of life and his intuitive feeling for its invisible sources and working. The husbandman is almost the last remaining type in Occidental civilization who is a craftsman guided by nature. If he loses his touch, there will be no guide left for us in our few years upon the earth.

We have not been concerned, in the inquiries recorded above, with the practice of artificial insemination as applied to human beings, but only with the possibility of discovering a Christian judgment upon its application to animals. Yet we cannot overlook the fact that this practice may be regarded as an experimental ground upon which the general advisability of human artificial insemination may be explored.

ARTIFICIAL INSEMINATION

By FRIEND SYKES

A Condensation of a Chapter from the Forthcoming Book soon to be published by Rodale Press called HUMUS AND THE FARMER

HOW, and in what way, are we likely to suffer as a result of this venal practice? (Artificial Insemination)

Since Charles Darwin laid the foundation for the study of the various phases of animal behaviour in his classical work on the *Descent of Man*, much research has been devoted to this very interesting and absorbing theme. That cynical contemporary of Darwin's — Carlyle — crudely abused his work, describing it as the 'Gospel of Dirt'. Darwin's great achievements, however, have survived the test of time while the withering cynicisms of Carlyle have long since been forgotten.

It was Darwin who first recorded the fierce battles and strange antics which characterize many of the 'lower orders of creation' when under the exaltation of sexual emotion, and he maintained that these manifestations were fraught with tremendous consequences to the species.

The facts which he brought to light have led to interminable discussions by subsequent scientists which unfortunately are still not as widely known as they might be. The Victorian mind had a curious false modesty about the discussion of sexual details, either in reference to human beings or to animals. To most people of that time, therefore, this discussion was forbidden fruit, but a courageous minority, who ate thereof and were expected to maintain a discreet silence, found it difficult to remain altogether dumb. They spoke, whenever they ventured into discussion, in veiled language, and it was only through art and poetry, classical literature and the drama that accurate knowledge reached the light of day—even so the subject had to be discussed indirectly.

Now, according to Pycraft, we are told 'that the stuff of which living things are made is called "protoplasm". Textbooks of physiology give its chemical constituents with fearsome accuracy, and each of these constituents can be isolated in the laboratory, but "all the king's horses and all the king's men" cannot build them up again into living matter. The consistent inconsistency of protoplasm defies us; every statement we make has to be qualified by reservations and saving clauses. Its permanency is attested by its endurance through millions of years, yet we are daily reminded of its evanescent nature. Its power of reproducing itself according to type none can doubt, yet no two individuals are exactly alike.

'This line of inquiry, then, takes one back to the simplest living things, among which there is neither marrying nor giving in marriage, neither birth nor death. Life is reduced to its simplest terms—a speck of animated jelly is all that confronts one, and this is only to be seen under the high power of the microscope. It has neither mouth nor organs of digestion; no visible means of locomotion are traceable, and the special senses of sight and hearing are wanting; but taste and smell, of a nebulous kind, are there. Shape it cannot be said to have, for its bodily outline is constantly changing, thereby it moves. A long tongue of its jelly-like substance—of protoplasm—is thrust forward, and the rest of the body is, as it were, dragged after it. Whatever animal or vegetable matter it passes over, in the course of its wanderings, is drawn up into the semi-fluid substance of this diaphanous body, and its juices are extracted, the undigestible residue being left be-

hind in the course of the morning's walk! In due time it becomes adult; further growth is impossible. When this stage is attained a strange thing happens. A certain minute, more solid portion of this body, which lies in the very centre of the mass and is known as the nucleus, begins to assume an hour-glass shape. Speedily the constriction becomes apparent across the whole body and, rapidly increasing, cuts it in two, as if by the tightening of some invisible thread. Here death is cheated, and records of births are unknown! And just as there are no parents so there are no children. But a foreshadowing of what is to be occurs even here. For every now and then two individuals, to all appearances identical, meet and promptly begin to merge the one into the other till they become one flesh. Here is the most primitive form of marriage in Nature. And here, in this union, or fusion, of separate entities of germ-plasm, we have the beginning of sex. Such unions are common among these primeval forms of life.'

At another point Pycraft goes on to say, 'After the instinct to feed, the two most powerful are the desire for self-preservation—the avoidance of danger—and the desire to mate. These two are the dominating instincts throughout the rest of the animal world, not even excepting man himself.

'The tremendous power of "mate-hunger" has been overlooked by a strange confusion between cause and effect. Almost universally its sequel, the production of offspring, has been regarded as the dominant instinct in the higher animals. This view has no foundation in fact. "Desire" for the sake of the pleasure it affords, and not its consequences, is the only hold on life which any race possesses. And this is true both in the case of man himself and of the beasts that perish. Wherever this instinct becomes weak, or defective, extinction speedily and inevitably follows. This "amorousness" is the motive power of "courtship" wherever it is met with; manifesting itself in the eccentric, and often grotesque posturings, or in the loud and often musical cries which constitute the study of courtship. Intensity of desire is indispensable to survival....

'The desire for sexual intercourse is met with only where the co-operation of two individuals is necessary to ensure the production of offspring. Such individuals being free to roam, must have some incentive to seek one another at the time when their germ-cells have attained maturity. And this incentive is furnished by the glands in which these elements are produced: supplemented by the secretions of certain ancillary glands. These stimulating juices are known as the "Hormones".

'But if we owe our existence to the gratification of what may be called our lower instincts, it is no less certain that all that is best in us we owe to our offspring. We meet with the beginnings of altruism, which the begetting of offspring entails, far down in the animal kingdom, and it attains to its full perfection in the human race. Here only, in its best and truest sense, love begins: though affection may be found, and in a high degree, in many of the lower animals....

'Those whose business it is, for one reason or another, to study these emotions know well that "mate-hunger" may be as ravenous as food-hunger, and that, exceptions apart, it is immensely more insistent in the males than in the females. But for this, reproduction in many species could not take place: for the sexes often live apart, and mates are only to be won after desperate conflict with powerful rivals no less inflamed. Thus it is idle to speak of an equality between the sexes in this matter, in regard to the human race. Dogmatism, and the frequent repetition of pretty platitudes, will not alter what Nature has ordained.... The male is dominated by the desire to gratify the sexual appetite; in the female this is counteracted by the stimulation of other instincts concerned with the cares of offspring....'

Elsewhere Pycraft says that 'the secondary sexual characters of the female are chiefly negative characters, the absence of those which are con-

spicuous in the male. She retains more of the primitive characters of the race. This is the rule in regard to the animal kingdom. Wherever we desire to find the onward tendency of evolution, the latest developments of the race, we turn to the male; when we desire to learn something of the past history of the species we turn to the female and young. This standard, of course, yields by no means uniform results, for we find every gradation of progress on the part of the latter, till male and female and young are externally indistinguishable.'

From the foregoing it will be seen that when we interfere in Nature's own methods, as we are undoubtedly doing when we play tricks in the name of science and give it the 'high falutin' title of Artificial Insemination, we are taking 'rash and hazardous' liberties and may be called upon for a fitting chastisement. It is quite impossible to visualize the form in which this punishment may be meted out either to the present generation who began this iniquitous practice, or to the succeeding generations who have to inherit the results of our misdemeanours. It may well be that the male, in this case the bull, may decline in usefulness and capabilities of a glandular character which cannot be visualized, while in the female there might well be somewhat corresponding glandular reactions even so extreme as to involve the complete drying up of the ovaries themselves.

The underlying emotions which Darwin and Pycraft emphasize and which are as much to be found in the animal kingdom as in human life, cannot be entirely disregarded by man, and the practice of artificial insemination may have disastrous effects which none can foresee. It is interesting to note that at the artificial insemination centres they are experiencing a variety of troubles already. The bulls are refusing to work and are becoming obstreperous. To overcome this the veterinary surgeon inserts his hand inside the rectum of the bull and works upon his organs, thus compelling him to drain his semen without the usual muscular activity which in Nature accompanies such ejection. It is a revolting practice which the veterinary surgeons concerned simply hate to perform. They are finding, however, that the bulls are refusing to work and recourse to this digusting expedient has been found necessary.

The female, too, finding no reciprocal satisfaction such as the usual sexual orgasm provides, in the course of generations—and perhaps in very few generations—will cease to take an interest in 'conception' and become equally difficult to persuade to go on breeding. In fact, the directions in which failure can take place are so many that they could only be adequately considered in a very long chapter.

My experience in dealing with nature as I have found it on the farm, both as regards animals, and the living plant, and the living soil, shows that so long as we leave nature very much to herself she usually takes best care of her affairs. It is when man with his artificialities, begins to interfere in the soil, in the plant, in animals, and in humans, that troubles begin.

Viewing this extending practice of artificial insemination, not from a moral standpoint alone, but from the point of common physiological knowledge, I feel sure we are playing with fire. I am familiar with all the arguments that are put forward about the grading up of our livestock, and theoretically I am in complete agreement with every well-founded aspiration that will attain this end. I am not, however, in sympathy, or prepared to support, without qualification, practices which are dangerously artificial; we have to look no further than the Thoroughbred breeding stock of our country to see what may happen.

For some three hundred years Thoroughbred breeding has received more attention than has yet been devoted to cattle stock of all kinds put together. One has only to consult the *Annual Stud Book Returns* to learn that something like a third of the mares at stud are reported barren each year. This is unassailable evidence

that all is not well with the Thoroughbred industry, and yet this has been conducted by people of the greatest skill using meticulous care to breed the best of animals regardless of expense.

Although there are still to be found in the Thoroughbred Lines a goodly number of individual horses of great racing qualities both as to stamina and speed, 80 per cent of the horses that are bred every year are so utterly worthless that they might as well be shot as sent to a racecourse to try to win races. This deterioration in our Thoroughbred stock is very real and while a few breeders do succeed, thanks to their great knowledge of breeding and rearing, in producing good stock from certain lines of blood, in the greater part of the Thoroughbred population it is very poor stuff indeed.

It will, therefore, be seen that the pitfalls lying ahead of the breeders of pedigree cattle stock are many and that when they begin to restrict the number of blood-lines on the male side, as is the inevitable practice at the artificial insemination centres, they may eventually find, as the Thoroughbred breeders have found, that nearly all their animals are related to one another, some of them carrying as many as seven crosses of the same line of blood. This is definitely not breeding for permanent constitution and cannot be for the good of any breed.

Three hundred years ago there were three hundred different blood-lines in the Thoroughbred breeding stock on the male side alone, with a larger variety of blood-lines on the female side. Today the whole of the Thoroughbred breeding stock, male and female, has been reduced to three families—Eclipse, Herod, and Matcham—and of these 95 per cent belong to Eclipse and the remaining 5 per cent is divided between Herod and Matcham. This is what intensive selective breeding is bound to develop into.

The value of a dairy cow is based on her ability to produce so many thousand gallons of milk and so much butter fat per annum. All the breeders have got this high-yield-and-high-percentage-of-butter-fat 'bug' in their brains, and in the future they are going to patronize only those bulls—those very few bulls—that are backed by these record breaking figures. This means that the lesser important performers in milk production and butter fat are not going to be bred from the male line, and we are going to intensify matings with the record-breaking champions.

According to my experience, high milk yields, coupled with mischievous factory-made concentrate feeding, are the present cause of much of the disease to be found in the dairy stock today. This weakness is going to be further intensified by inbreeding with the inevitable result that the constitution of the beast will be further depleted.

From every point of view, therefore, —moral, physiological and economic— artificial insemination may bring in its train the complete undermining of the health of our livestock—if not its ultimate extinction.

These four articles will be reprinted for 2c plus postage.

LECTURES ON ORGANICULTURE

DURING the past year we have had many calls for speakers, suggested materials, and lecture outlines from garden clubs and service clubs. Unfortunately we have been able to accept only a limited few invitations to speak to clubs. We wish we could accept them all. In leafing through the various issues of the Organic Gardening Magazine for this year a few days ago I was impressed by the large amount of material that could be presented to various garden clubs. It occured to me then that it might be helpful to suggest materials for a number of lectures that should interest all farmers and gardeners.

Dr. William H. Eyster.

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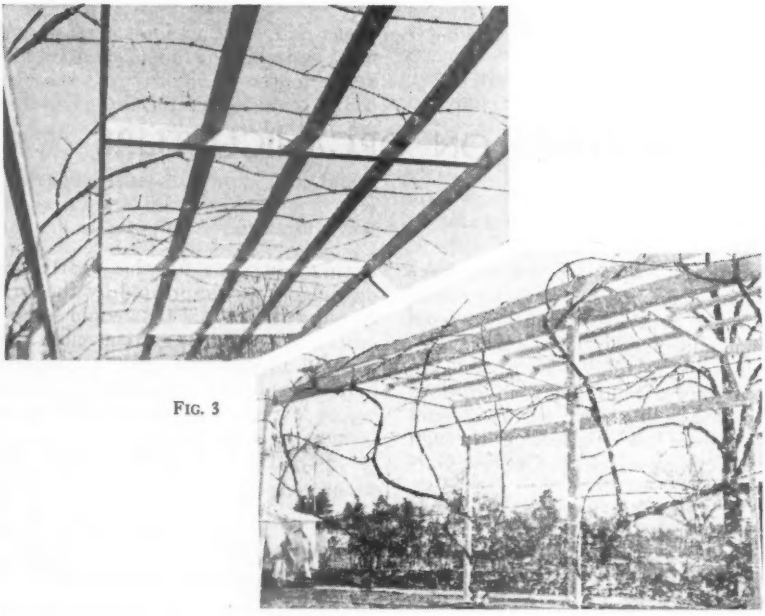

FIG. 3

HOW TO PRUNE THE GRAPE

Adapted from the *Pruning Book* by Gustave L. Wittrock, Rodale Press.

By DR. WILLIAM H. EYSTER

THE grape is one of the oldest and most significant fruits of man. It is mentioned in the parables of the Bible. It has been grown by the Egyptians for 6000 years, and was highly developed by the Greeks and Romans. It seems to have originated in the Caspian Sea area of Western Asia.

The pruning of grapes may be done anytime after Thanksgiving and before the middle of March. In regions where there is little danger of winter freezing of the vines, pruning may well be done in the fall when it can be done more leisurely. The prunings are excellent to incorporate in the compost heap with autumnal leaves to prevent the leaves from packing into tight layers. To get the best results it is quite important that grapes be pruned annually. If this is not done, the vines may grow to such an extent that they outbalance the root system. Pruning the grape is not a difficult process. It is important to realize that the fruit bearing shoots grow from winter buds on canes that developed the previous season. Fruits are produced only on new shoots of the current season. Grapes are divided into two cultural types: the bush type and the vine type, as illustrated in Fig. 1.

The specific pruning care of the bush type, which is applied mostly to the European species, starts the second year after planting. The first year's care is limited to training the plant. Allow only one strong, carefully select-

ed cane to grow and remove all lateral branches from it. All other canes should be cut out.

This cane should be staked and tied at intervals to keep it upright and straight, because it is to form the trunk of the future grape bush. In dormant pruning, cut this trunk back to about 2 or 3 inches above the top of the stake, the height of the stake being determined by the grower (usually 2 feet). In the spring allow only two top buds to send out shoots, cutting off all the others and removing them smoothly so that no laterals may develop at the point of cutting. The two canes may be permitted to grow during the summer and establish the bush with a good root system. The following dormant season is the beginning of the annual pruning of the bush type grape. All canes that develop on the mature bush during the summer should be cut back to one-half or three-fourths of an inch above the second bud at the base of the cane.

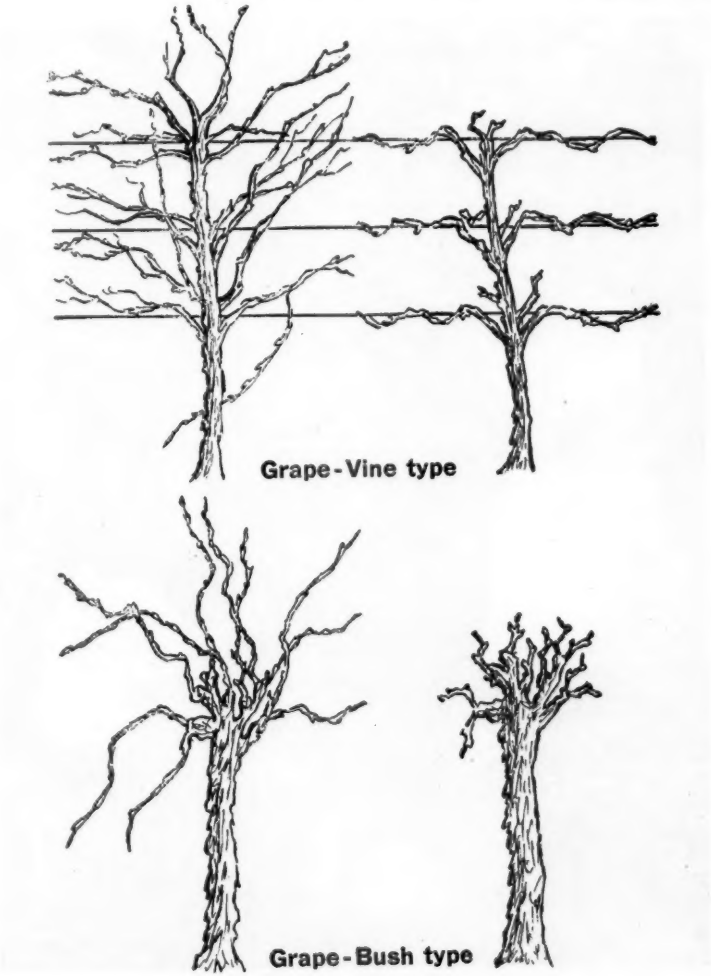

FIG. 1 Cultural types of the Grape

If one bud has been injured or killed, the other will always be there to carry on, and if the plant is vigorous, both buds may grow into strong shoots. Do not remove the extra growth since both new canes will bear fruit the following season. The supporting stake should be removed as soon as the trunk is strong enough to support its crown.

In training a bush type grape on an arbor or trellis one must observe the early training of the central trunk. This is started with a main, long cane trained vertically up one side of the arbor. When the cane has reached the top of the arbor, permit a central crown consisting of a series of lateral canes to develop. These may be permitted to grow either fan-wise or radially from the trunk to be, or they may be arranged in parallel rows on top of the arbor if spaced from 12 to 15 inches apart. These horizontal permanent canes must be allowed to grow sufficiently long to become the foun-

FIG. 2 The Vine type of Grape

dation for a series of crowns at their ends from which new canes will develop and form the fruit. The ends of the permanent canes will be the crowns treated by the two eye method, as described for the bush type.

The vine-type pruning is applied specifically to American species of grapes. They are natural climbers and do best when permitted to grow on a trellis. Many systems of pruning are used in America and are based on the 3-wire fence type of trellis. Basically, a trunk is started similar to the bush type, but once established, pruning is not limited to 2 buds but to from 3 to 5 buds. This results in a cane from 3 to 4 feet long. Select 6 of the best canes, training 3 canes in one direction and 3 in the opposite direction. Remove all other canes. Canes ¼ of an inch thick are the best to select. Thicker canes grow vigorously but are called "Bull canes" and, in general, bear inferior bunches of grapes. This type of pruning permits the developing of from 30 to 75 bunches of grapes to a plant, thus giving bigger clusters, larger berries, greater weight, and superior flavor. A vine-type of grape which has been trained to an arbor is shown in Fig. 2. The parallel rows of canes over the top of the arbor are illustrated in Fig. 3. From the pruned, lateral branches of these canes grow the new fruit-producing canes. The harvest rewards this method of pruning remarkably in spite of the severe pruning.

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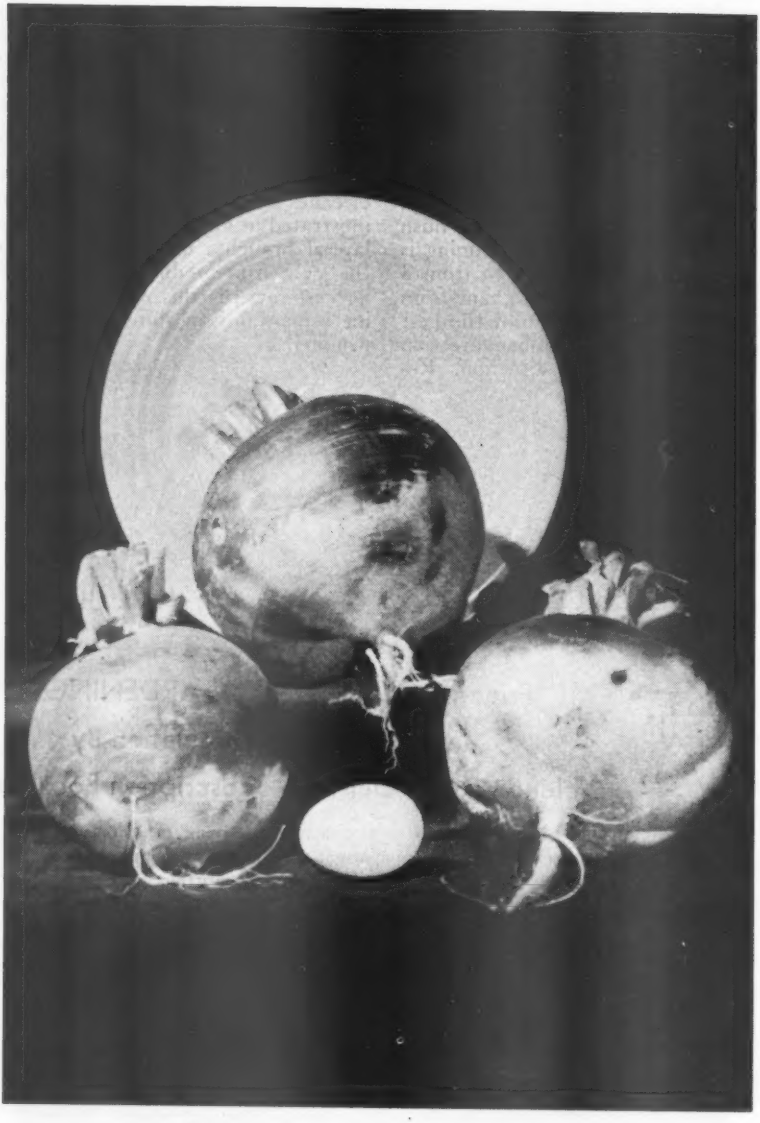

1912 Washington Ave.,
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Organic Gardening
Emmaus, Penna.

Gentlemen:

Four years ago, I knew nothing about gardening, but thought I would like to try. I had a small space spaded up for my garden, it was a yellow clay. I knew nothing about soil, so I struggled along with that clay soil for two years, with plenty of hard work and very poor results. The ground would bake so the seed I had planted could not get through the ground and if they did get through the ground the soil would bake around the small plants, so they could not grow. When I would try and loesen the soil it would disturb the root system of the small plants. For example, when I would plant onion sets and the onions were ready to use, I would have to spade them out of the ground, so as to not pull the tops off the onions.

Two years ago I subscribed for your Organic Gardening, after reading it I decided to try compost. I went after the compost in a big way and wish to say I think, there is nothing will take the place of Organic Gardening. The soil is now very mellow, easy to work and grown the best vegetables and flowers I ever saw. The vegetables are more tender and taste much better than vegetables grown by other methods.

This year I had beets that weighed 4½ lbs. and turnips weighing 3½ lbs. each and everything else I raised was along this same line. I now have another huge compost pile ready to use this spring.

I am enclosing a picture of the turnips which I think is very good for a person to raise, that knows nothing about gardening. I just know to use plenty of compost and everything else takes care of its self.

Yours very truly,

E. E. Young, Supt.

E. E. Young, Supt.
South Penn Natural Gas Co.

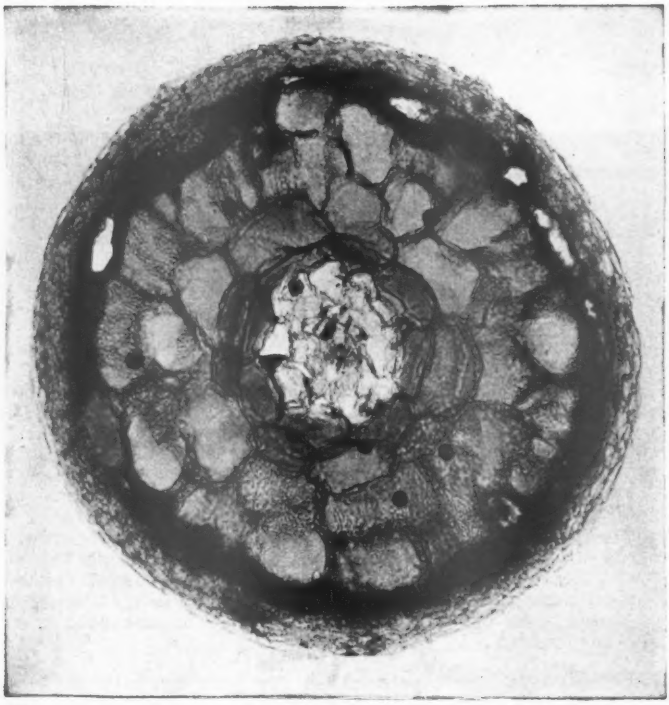


FIG. 34. A cross section of an ectotropic mycorrhiza showing the young root enclosed by a mycelial sheath. Note also that the fungous hypae grow into the root and invade the spaces between the cells of the cortex of the root. This is a cross section of a rootlet shown in FIG. 33. (After Rayner).

Botany For The Gardener (14)

By DR. WILLIAM H. EYSTER

Plants in the Soil

Mycorrhiza

MANY of the most common higher fungi form symbiotic and mutually beneficial associations with the roots of higher plants. These associations are called *mycorrhizae,* meaning fungus roots. The discovery of this association between soil fungi and the roots of higher plants was made by a botanist named Kamienski and announced by him in 1881. About this time the German Government, desirous of increasing the supply of truffles available for market, asked a well-known German botanist, Prof. A. B. Frank of Berlin, for help. The truffle fungi live in woodland soils and form among the roots of oak and beech and sometimes other trees edible fruiting structures that look like large tubers. The fungus, *Tuber aestivum,* produces truffles that formerly were collected for market in southern England. For

finding these underground truffles, pigs were used. Another species of truffles is native in France and elsewhere in Europe and is highly esteemed for its delicate and delicious flavor. This species forms mycorrhizal associations with evergreen oaks and sometimes the common oak.

In the course of his studies of the truffle fungi Prof. Frank observed that the greater part of the fibrous roots of the oaks and beeches were shorter and thicker than ordinary rootlets, and varied in color from creamy yellow and pink to bright golden-yellow to dark brown or almost black. Each modified rootlet was found to consist of a young root enveloped by a sheath of fungous hyphae. The color and thickness of this mycelial mantle varied with the species of tree and the age of the rootlet. The more or less complete absence of root hairs in the region of absorption and their replacement by the mantle of fungous mycelium suggested that the mycorrhizae play an important role in the passage of nutrient materials from the soil into the root. (Fig. 33) Prof. Frank found that mycorrhizae occur also on the roots of

FIG. 33. The mycorrhizae of Scotch pine. Note that the rootlets are thickened and repeatedly forked so as to have the appearance of coral. (After Rayner).

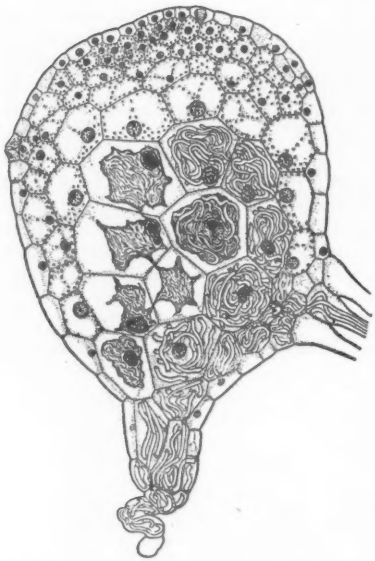
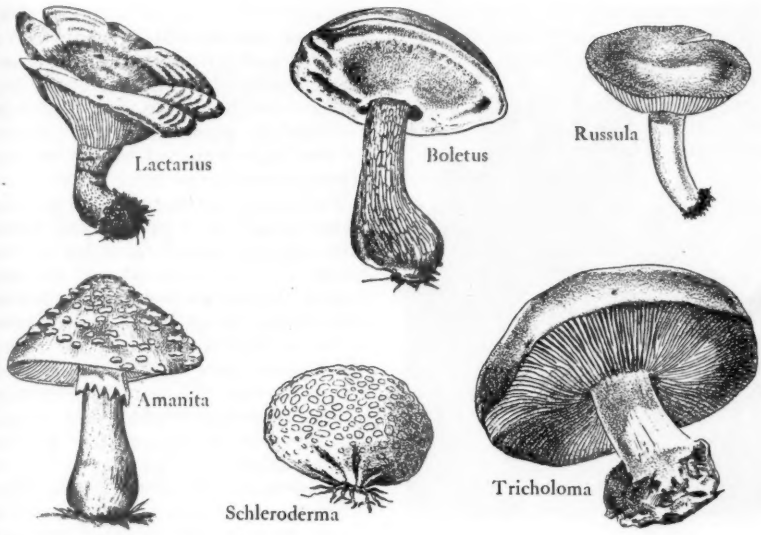


FIG. 35. Median longitudinal section of an orchid seedling one month after infection by the mycorrhiza fungus. Note the fungous hyphae in the form of a twisted mass in many of the cells. (After Bernard).

alder, hazel, hornbeam, chestnut, pine, spruce, and other common trees of the woodland.

Penetration of certain soil organisms into the roots of most plants, including annuals and perennials, herbaceous as well as woody, is the rule rather than the exception. The roots of all plants growing in the soil are liable to invasion by any fungus in the soil. Some fungi may attack the roots and destroy them under certain soil conditions. Under more favorable conditions and in the case of other fungi, the roots are able to overcome the attacks of the fungi and may even be benefited by them. A beneficial association between a fungus and the roots of a higher plant we have already referred to as a *mycorrhiza.* Recent studies indicate that mycorrhizae are a wide-spread and common phenomenon among plants. The extent of the penetration of the fungus and the degree of its effect upon the growth of the plant vary with the soil conditions which determine the vigor of the plant, the degree of its resistance, and the kinds of fungi which occur in the soil. Under favorable cultural conditions there may be no apparent injury to the plant, but under adverse conditions of moisture, temperature, or nutrient supply, the fungus may become a parasite instead of a mycorrhizal comrade and cause definite injury to the roots and to the entire plant.

Kinds of Mycorrhizae—The nature of the mycorrhizae produced in the case of various plants and the part they play in the plant's nutrition differ in different plants. In some plants and especially in the trees of woodlands the fungus does not penetrate into the cells of the root but forms a sheath of hyphae around the tips of the roots, entering the tissue largely between the cells. This is called an *ectotropic mycorrhiza.* The structural features of this kind of mycorrhiza can be seen from the cross section of a rootlet enclosed by an ectotropic mycorrhiza illustrated in Fig. 34. Other fungi invade the cells within the roots and produce what is called an *endotropic mycorrhiza.* This type of mycorrhiza is illustrated in the median longitudinal section of an orchid seedling shown in Fig. 35. Endotropic mycorrhizae occur in such common trees as ash, walnut, sycamore, poplar, and certain conifers. They are common in plants belonging to the heath family (woodland shrubs), orchids, and many herbaceous plants including many of the commoner crop plants of tropical and temperate regions. Rootlets having endotropic mycorrhizae usually do not differ noticeably in external appearance from ordinary roots. Although the fungi penetrate the cortical tissues of the roots, the plants show no signs of injury although the fungi doubtless take carbohydrates and other organic materials from the roots. The mycorrhiza within a root comes to an end with the onset of a digestive process on the part of the individual root-cells, which results in the rapid decomposition of the mycelium and the gradual disappearance of most of the products of digestion



FRUITING STRUCTURES OF COMMON MYCORRHIZAL FUNGI

from the cells of the root. In this way the root recovers any foods the fungus may have taken from it plus others that the fungus may have secured from the soil outside the root. In some species of heath plants, the fungus invades the host plant more or less completely and invades every part of the plant except the embryo and endosperm of the seed. The seed coat, and pericarp, however, are invaded by the fungus which serves to inoculate the seedling as soon as it bursts out of the seed coat in germination. As a rule a mycorrhizal fungus grows poorly without its vascular partner and often only with a particular species of plant.

The Mycorrhizal Fungi—Many of the fungi which form mycorrhizal associations with the roots of trees belong to the great group of fungi known as the *Basidiomycetes*. These fungi are characterized by the formation of spores on enlarged ends of hyphae called *basidia*. The basidia are borne in great numbers in rather large and familiar fruiting structures including toadstools, puffballs, and brackets. The fruiting structures of some of the commonest mycorrhizal fungi are shown in Fig. 36. These include the genera *Amanita* or deadly fly poison on the roots of pine, spruce, and birch; *Boletus* on pine, spruce, larch, beech, and oak; *Lactarius* on pine and other trees; *Russula* on various trees; *Tricholoma* on many trees; *Slceroderma* on beech and oak; and *Rhizopogon* on pine.

Mycorrhiza in the Nutrition of Higher Plants—Prof. Frank's theory was, as we have seen, that in ectotropic mycorrhiza the mycelial mantle takes over the work of absorbing water and nutrients from the soil which is usually performed by the root hairs. The fungus absorbs the minerals and the nitrogenous materials from the soil organic matter, while the higher plant supplies the fungus with carbohydrates. The cells of the root harboring the fungus generally are lower in carbohydrates and higher in proteins than normal cells. Under natural conditions orchid seeds will not germinate unless they are associated with an appropriate fungus. Since the germination of orchid seeds depends on an

FIG. 37. Peach tree 16 months after planting in compost.

available supply of organic matter it is believed that the role of the fungus may consist merely in supplying organic matter.

It is believed that at least some of the endotropic mycorrhizae are capable of fixing nitrogen. This is indicated by the fact that plants belonging to the heath family (*Ericaceae*) grow on poor soils deficient in available nitrogen. *Phoma radicis* is known to be capable of fixing atmospheric nitrogen.

Many of the mycorrhizal fungi are Basidiomycetes which are capable of digesting lignin and other difficultly soluble organic substances. These fungi break down much more organic matter than they need themselves and thus make it available to the higher plants. The fungus obtains its nitrogen from the soil organic matter or synthesizes its proteins from the inorganic salts of the soil. The plant is known to digest the fungus in much the same way as an insectivorous plant digests insect bodies. This source of nitrogenous matter may play a much more important role in the nutrition and health of a plant than we now realize. The fungous tissue may contain as much as 10 per cent of nitrogen in the form of protein which is digested and assimilated by the plant. The presence of the fungus in the root appears to be associated with the health of the plant. This may account for the high degree of health of most plants grown out of cultivation.

The association between fungus and higher plant in a mycorrhiza varies from almost complete independence on the part of both plants, through various degrees of mutually beneficial relationships to an obligate association as in orchids and ericaceous plants which can not live without their fungus partner. There may be circumstances also under which the fungus may live on its mycorrhizal partner as a parasite.

Mycorrhiza and Fruit Trees—Mycorrhizae are known to occur in apple, peach, plum, citrus, banana, custard apple, and doubtless occur in other fruit trees as well. The process of mycorrhiza formation may be observed under the microscope. By arranging a vertical darkened glass window on the side of a deep pit in an orchard, it is not difficult to see with the help of a good lens or a low powered horizontal microscope some of these soil fungi at work. They are visible between the soil particles as glistening white branching threads similar in appearance to a cobweb. The fungous threads may be seen approaching the young roots in the absorptive region just back of the root tips on which the root hairs are formed. When this region of the root is examined under a high powered microscope, it can be seen that the fungous hyphae actually invade the cells of the root to form an endotropic mycorrhiza. The hyphae can be observed passing from one cell to another. In the cells the hyphae remain but a short time when they are digested and absorbed by the plant.

The importance of the mycorrhiza to the apple tree is clearly indicated by the following observations made by the late Sir Albert Howard: "I have just obtained confirmatory results which prove how important

humus is in helping a mycorrhiza-former to throw off disease. In 1934 I acquired a garden with worn-out soil. The apple trees were literally smothered with American blight, green fly, and fruit-destroying caterpillars like the codling moth. The quality of the fruit was poor. Nothing was done to control these pests beyond the gradual building up of the humus content of the soil. In three years, the parasites disappeared; the trees were transformed; the foliage and the new wood leave nothing to be desired; the quality of the fruit is first class. The meaning of all this is clear. Nature has provided a marvelous piece of machinery for conferring disease-resistance on the crop. This machinery is only active in soil rich in humus; it is inactive or absent in infertile land and in similar soils manured with chemicals." (Agricultural Testament, page 167.) An apple tree on the Organic Gardening Experimental Farm has responded similarly to the enrichment of the soil with humus and the mulching of the ground under the tree with stones.

Other common fruit trees which are mycorrhiza-formers are peach, plum, citrus, and practically all nut trees. These trees, like apple, respond to the building up of the humus content of the soil. The peach tree shown in Fig. 37 is growing in the site of an old rock pile which had been collecting humus for 50 years. It has never been exposed to artificial chemical fertilizers or sprays. It has never been attacked by borers or other pests or diseases.

Mycorrihza on Grapes—Because the grape is a mycorrhiza-former, humus in the soil is essential for perfect and complete and well balanced nutrition. A vineyard near the village of Jouques in the Department of Bouches du Rhone, France has a local reputation for the quality of its wine. An examination of the roots of some of the vines revealed an abundant mycorrhizal association which doubtless is responsible for the perfect nutrition, the high quality, the good keeping qualities of the grapes, the long life of the plants, and the absence of disease. Neither artificial chemical fertilizers nor poisonous sprays are used in this vineyard. It is in strong contrast with many other vineyards in France, but quite like those in Central Asia where artificial chemical fertilizers are never used.

Mycorrhiza in Grasses and other Cover Crops—It is well known that roots of legumes are invaded by nitrogen-fixing bacteria and there form a symbiotic relationship, an association which benefits the bacteria and the leguminous plant. The bacteria take food from the plant and grow into large colonies which cause nodules to be formed on the roots. At the same time the bacteria absorb nitrogen out of the air and build it into organic compounds which sooner or later become available to the higher plants. It is less well known that the roots of many leguminous plants form mycorrhizal associations with certain fungi in the soil.

Grasses which thrive in soils rich in humus have also been found to be mycorrhiza-formers. One of the first grasses in which the mycorrhizal association was studied is the sugar cane. The addition of humus to the soil is followed by the establishment of abundant mycorrhiza formation and the rapid digestion of the fungus by the roots of the cane. The cultural practice of hilling up the ground around the plants in certain parts of Asia provides favorable conditions for the development of the mycorrhiza.

Rice, another grass, is a mycorrhiza-former. This accounts for the remarkable response this crop makes to the addition of humus to the soil. Yield, quality, disease resistance, as well as the nutritive value of the grain is associated with the abundance of the mycorrhizal formations.

Other Mycorrhiza Formers—Other mycorrhiza formers include cotton, hops, strawberries, bulbous plants, tung, cardamons, banana, coffee, coconuts, tea, and doubtless many, many other plants. It may not be an overstatement to say that practically all

land plants form some kind of symbiotic relationship with soil organisms. This association can take place, as a rule, only in soils which are rich in humus and therefore capable of supporting an abundant population of soil organisms in good balance. If fungus or other soil organism and crop plant associations give to the latter a high resistance to diseases and insect pests, the addition of organic matter to the soil is of even greater value in agriculture than is at present supposed. Doubtless many important soil organism-higher plant relationships still remain to be discovered. The tomato and potato, for example, are not now known to be mycorrhiza formers but both respond to humus as though they had such associations with soil fungi. It is possible that such plants utilize the proteins and other organic substances in the bodies of bacteria instead of the higher fungi.

Announcing Prize Contest . . . .

Help us to write a book on Leaves

We are interested in collecting all possible information on the leaves of trees as sources of organic matter and plant nutrients. In this connection we invite all organic gardeners to help us by entering our prize winning contest which we here announce. For ideas; experiences; chemical analyses of different kinds of leaves; composting values of different leaves; designs or descriptions of machines for grinding, collecting, transporting, or otherwise preparing leaves for composting or for mulching; photographs; results in garden or orchard from the use of leaves; or for any other information concerning the use of leaves for improving the condition of the soil, Organic Gardening will give:

FIRST PRIZE . . .	$50.00
SECOND PRIZE . . .	$25.00
FIVE PRIZES . . .	each, $10.00

The prize winning contributions will be used in a new book entitled, "Gardening with Leaves". For any materials used which are not given a prize, we will pay $5.00. All contributions must be in the mails and postmarked not later than February 28, 1949. The editorial staff shall be the judges and their decisions must be accepted as final. Thousands of tons of leaves rich in humus and nutrient materials, including the often deficient trace elements which are pumped up from the lower layers of the soil by the roots of the trees, are burned each year. Leaves are perfect mulching materials designed by Mother Nature. Let's use them in our soil.

Composting and Soil Problems in Southern, Warm and Dry Climates

By DR. EHRENFRIED PFEIFFER

DRY, warm climates present quite a few problems which are different from those encountered in moderate and Northern climates. Drought counteracts bacterial action and earthworm growth, for all the microlife of the soil needs moisture. Then too, warm soils, which heat up easily, weather away very quickly under prolonged, intensive sun radiation. Under such conditions, even granite rock gets brittle and swiftly weathers into a sandy, gravelly soil. Such granite decomposition soil, in the South and Southwest, is very fertile as long as the rains and natural moisture support plant growth. Without moisture it can remain desert. Chemical analysis reveals a high percentage of available minerals, potassium and phosphate, for instance, and less calcium. If there is some organic matter present, then with the rains a high nitrate content might be found. But, without organic matter, these soils wash out very easily and lose their high chemical rating.

The washed out products together with clay and soluble humic acids are then deposited in the valley bottoms. There they may cake into a hard pan, the so-called adobe soils of Southern California, which make excellent material for adobe building bricks, but are exasperating to cultivate. These soils thus fall under two extreme categories, the hard caked variety, just mentioned, and the very loose, crumbly type on the slopes. The latter, with alternate, increasing washing and burning, become unfertile, eroded and gullied unless there is a plant cover.

The amount of clay present determines whether a soil will hold its own or lose out. Clay is a colloid which absorbs and retains moisture. When drought sets in, the clay soils hold out longer, thus enabling soil life to establish itself over a longer period and to form humus. Once humus forms, and is not lost again, the situation is fairly secure. The soils with humus hold and lend themselves to successful cultivation. As long as there is moisture, rain, even mist, and/or irrigation these soils will be extremely fertile. However, humus is broken down under intensive sun radiation and conditions of drought. Shading, with cover crops or mulching, is extremely important. One can see the most beautiful, crumbly soil, rich in organic matter, underneath the trees in an orange grove as far as their shade reaches and the fallen leaves mulch the soil. Only one layer of leaves is enough to do the job. A few inches away, on the unprotected interspace between the rows, one can see hard crusted surfaces, sometimes so hard that they will not even absorb the irrigation water. Simply raking the leaves out from under these very same trees (where the soil is sheltered enough anyhow) and spreading them over the interspaces would bring about an excellent soil condition there. However, the present orange grower thinks this would require too much labor and spends more time and money in cultivating the crust, or, more recently, in applying light oils to prevent weed growth, or in other operations.

It is claimed that this practice of oiling does not crust the soil. The writer saw oiled soils which were not crusted and others which were. The

fundamental difference seems to be that the crusted ones had been mineralized before oiling. The oiling then increased the crust, while in other soils a sufficient amount of manure and compost and soil life too was present so that the soils reacted favorably and have been able to stand the oiling. Nobody can predict how long this will be so.

Recently, the writer had the opportunity of studying an interesting example of these Southwestern soils. Granite decomposition soils as well as Mojave desert soils can be relatively rich in available minerals. Desert dust is rich in potassium. Soil analyses can be deceiving to the inexperienced. The owner of the soil analyzed may even point to a neighbor's place where—with sufficient irrigation—lush alfalfa grows. On the basis of the high mineral content of his own soil, he tries the same and nothing grows. The difference is that the neighbor's soil contains clay as well as decomposition sand and has a clay pan nine inches below the surface, while his soils contain no clay and are made up only of decomposition soils and sand, three to four feet in depth. In the latter case, all moisture is lost, seeping downward and evaporating quickly, because sandy, granite soils heat up very quickly, while clay and humus are "cold" and thus lose less moisture. The sandy decomposition soil needs more irrigation, but it too will be lost. In order to succeed, such soils would need clay, plus humus, plus shade, plus mulch.

However, if these soils are constantly watered, and do not dry out, then a natural balance between precipitation and evaporation can be maintained and a most beautiful humus soil will develop, even without the addition of organic matter, compost or manure, chiefly by means of the microlife naturally present. It is then up to man to maintain the fertility and ideal conditions by cover crops, avoiding excessive irrigation which would cake the soil, and by proper crop rotations which balance exhausting crops (corn, cabbage, beets) with restoring crops (legumes, or plants and trees) which shade the soil. In summing up, one can say that the control of moisture, shade and humus decides whether such soils will hold or be lost.

This behavior of soils can give us leads for the development of proper composting methods in a hot, dry climate. The most important rule: Never let your compost pile dry out. Eighty per cent of all the compost piles which the writer saw in California in recent weeks were too dry. When such material is spread on a dry or caked soil it will not be absorbed, even when plowed or harrowed under. It will lie inert and have little value until the rain comes. Much valuable time is lost. It is *this* time which counts in the improvement of the soil and *not* the time which is spent in attending properly to compost practices. The composting which is done *right* will pay.

Bulky material such as dried out, tall weeds, the leaves of orange, avocado, and eucalyptus trees, even sage, can be composted if shredded. Many of the compost heaps contained these materials but they were dry with lots of air spaces and dry soil in between. No fermentation could take place. It is best, therefore, to place a compost heap under the shelter of trees to help against its drying out. (Contrary to general belief, eucalyptus trees do no harm when used for wind protection. If they grow too tall, top them and sever the roots which tend to spread out too far into the orchard or field.) If there is no natural shelter available a simple shed can be built to take its place. Set a few upright posts: these need not be high, just tall enough to enable you to work the heap easily. Then use some perforated material as a cover (tin, for instance) which will give enough shade yet let the rain through. Slant this roof so that the rain can still run onto the heap. A chicken wire screen covered with large leaves, Spanish moss, or weeds also makes an adequate shelter. If you have irrigation at hand lead a ditch or pipe near the heap. Build the heap up in a pit, about 2 feet in depth, and

let the water soak through from underneath and around the heap. In the first stages you can let the water run on the material. It is very important that all dry material be wet down thoroughly while building your heap. After shredding, mix the organic material with earth, and never forget to cover the whole heap as soon as it is completed. If you do not have enough earth for this cover then use leaves, old sacking, plants, anything which does not seal it up yet still provides a skin for it. Under the warm conditions prevalent there in the South fermentation will be much more rapid than in the North. Well built heaps are often ready after two months. And the writer has seen heaps in fine condition, described as considerably less than two months old, where the pit system was used with the addition of earthworms.

A completely rotted compost should be used up quickly. Of course, as long as it is kept sponge moist and covered, it will keep for many months, maybe more than a year. But if it is allowed to dry out it will lose a great deal, particularly nitrogen. It should be worked into the surface right with the planting of the crops.

A half-rotted compost of coarse material is best for mulching on top of the soil, covering the interspaces between plants or trees. It is only necessary to mulch between the rows in groves of full grown orange and avocado trees, or of young walnut trees. For most young trees mulching nearer to the trunk is advisable, unless one uses cover crops. But a ring, one to two feet in width, should be left free around the trunk. Sometimes one sees the compost or mulch piling up against the tree trunks. When this happens, the air bark is covered and rots, is given over to infections and pests which hide underneath the loosened bark. When the area around the trees builds up too high through mulching, it should be leveled out again. One often sees trees in gardens which are too deeply "buried". If you dig out such a tree you will see old roots growing horizontally and downward, while the young roots grow upward. This might cause disturbances in the circulation of the sap, resulting in the gum bleeding of apricots, almonds and peaches.

In connection with the humus management, the right handling of irrigation is also important. Basin irrigation, where the water stands for a long time until it soaks in, crusts the soil and produces a hardpan underneath. Caked surfaces resist irrigation and lead to water losses. Mineralized soils, without absorbing humus, also behave in this way. The cultivated surface is best for irrigation; so is the furrow system. Here, one allows just enough water to run down the furrow to reach the other end. So often one hears complaints about the lack of water and then sees people wasting great quantities through wrong practices on caked soils. The most ideal conditions for absorption are present just after a mulch cover has been worked in or removed. After irrigating orchards or gardens, one might mulch again to hold the moisture. This is easily done in small gardens, but large areas present difficulties. Some day a mulching machine might be constructed which drops the material like a manure spreader and rakes the mulch into windrows, then spreads it from the rows out over the land. This machine might be a kind of combination of the side delivery and dump rakes, i.e. reversing the windrow action. So far as we know, such machines have not yet been experimented with, but it is to be hoped that somebody with initiative and mechanical as well as organic insight may develop adequate machinery for large scale operations.

Agriculture in extreme climatic conditions such as those of Florida or California tends toward onesidedness. The diversified pattern has been lost. The fact that one can make a living by growing a few specialized crops on small acreages has produced such phenomena as the "farmer" or "orchardist" who has *only* beans, or artichokes, or lettuce, or oranges, or avocados. These partial or complete mon-

ocultures draw upon the soil resources in a onesided way. Mineral and trace mineral deficiencies occur, plants gradually get weaker, a very specialized, monotonous microflora develops and the farmer is surprised that plant diseases and pests increase. In order to survive, he takes the labor and expense of spraying insecticides in his stride. When balancing organic methods are mentioned the objection is raised that they are too complicated and involve too much labor. Old orange growers tell us that in their youth, maybe 40 or 50 years ago, no pests or diseases were encountered. In those times, manure and mulching was the order of the day. They changed to modern methods. It is so easy to call up the nearest airport and have a plane come and spray insecticides. The changes of quality in foods and soils which result are not taken into consideration. The general public is not yet quality and health conscious. People still judge by size, packaging and labeling.

Recently, a "quick die disease" in oranges worries the California growers. One can observe the older growers putting all the manure and mulch they can scrape up back onto the orchards in order to save the situation. Others believe in oiling. Few as yet have the courage to try organic methods. Indeed, it is difficult to introduce a balanced, diversified system in a situation as onesided as a citrus growth or a vegetable farm which produces only one or two kinds of crops. It may be necessary to compromise, for example, by using as many different kinds of materials as possible for compost (garbage, leaves, weeds, etc.) in order to add something "different" to the soil.

In California, alfalfa hay is considered by the old timers to be the ideal mulch for fruit trees. One of these men told us that he used it as long as it was cheap and never had any trouble with his trees. Nowadays it is too expensive, but organic composting methods could take its place. This same man told us that were one of his groves to die off, he would plant alfalfa to rejuvenate the soil and sell the hay for mulch. He felt that this would be more profitable. Twenty years ago, it took 125 oranges to fill a box, now it takes 185 to 225 to fill the same size box. The harvest of a successful grower, two decades ago, was 1100 boxes per acre. From the same land, he now harvests 800 boxes.

Were I in possession of an orange grove or a truck garden monoculture, I would try to grab any and every possible organic material from outside plus small amounts of manure and apply it to my land. As a matter of fact, I observed in many of the small one to three acre lots and gardens that, with the lush and fast growth of trees in these Southern climates and sufficient irrigation, such large masses of organic matter can be grown that they more than suffice for the fertilizer needs of the land. In one two acre garden of mixed fruit trees and vegetables a two years supply of compost was collected in one year. In fact, it was necessary to advise the owner to step his production down a bit. In this particular situation it will come true that compost will be a natural cash crop.

It is the small lot which can be intensively developed, while with increasing size the problems grow too. This again should stimulate consideration of a possible future development: Subdivision in mixed cultures which can be handled by one man, instead of large monocultures. Pests dwindle away in such small controlled areas. California, at present, is considered by many to be the new frontier. She has a weekly influx of thousands of people who seek a better future in a favorable climate. Large monocultures will not be available to nourish and supply such an increasing population with work. The small, diversified grower could make a living and survive. The trend in population, the soil, and health conditions favor the natural, organic, self-sustaining unit. These alone will be able to absorb the increasing population and make possible its survival.

Garden Calendar—January

January is the month of new seed catalogs which usually arrive before the Christmas decorations have been completely cleared away. It is the time to formulate the plans for your garden in the new year. Even though you are not a landscape architect or a designer, lay out your garden on paper. Indicate the garden paths, the places for the rows of vegetables and the beds of flowers. By proper planning at this time a garden can be beautiful as well as a source of health-promoting foods. You should consider a mixed garden including vegetables, flowers, and herbs. Mixed or companion plantings are worth considering. It is not too early to decide what seeds and plants will be needed to make your plantings. You doubtless have saved seeds from your own plants in last year's garden. Buy only the kinds and amounts of seeds that you will need to plant your garden. In selecting your seeds, keep in mind the height of the mature plants, time of blooming, color of flowers, time of maturing of fruits and seeds, and other plant characteristics which will add to the beauty and usefulness of the garden.

THE NORTH

Flower Garden:—Inspect your stored bulbs and tubers in the cellar to guard against their becoming too dry. They keep best in moist sand. Tender bulbs must be protected from freezing temperatures.

Sow seeds of such small-seeded annuals as petunia, snapdragon, lobelia, candytuft, cornflower, begonia vinca, verbena, delphinium, dahlia, summer flowering carnation, and pansy for outdoor flowering. For greenhouse flowering, sow gloxinia, tuberous-rooted begonia, kalanchoe, Christmas cherry (Solanum capsicastrum), calceolaria, cyclamen, and gloxinia.

Other seeds that may be sown at this time are dusty miller, bellis, genneria, myosotis, and pentstemon.

Water African violets from the bottom with water having approximately the same temperature as that of the room. Do not wet the leaves. The plants prefer a light window but object to direct sunlight.

Christmas plants can be kept beautiful and cheerful a long time if they are given proper care. Check the plants of your window garden to determine which, if any, need repotting. Carefully knock out the ball of earth and if a mass of roots is showing, the plant needs repotting and should be transferred to a pot that is 1½ to 2 inches larger in diameter. Pinch back weak and straggling growth.

Hydrangea, azalea, and other plants for Easter should be started during January. Sunny days may bring to life some of your rock garden plants. See that none of them have their roots exposed unduly and if they have, press them down gently into the soft earth.

Shrubs and Trees:—Shake snow from evergreens before it freezes on the branches in such amounts as to break them down. Branches removed carefully from forsythia, flowering quince, winter jasmine, early flowering plum,

and other spring-flowering shrubs and trees may be brought indoors and forced into bloom for colorful winter bouquets. For this purpose, select the longer branches and put them in large deep containers filled with water. They will bloom better in a cool than in a warm room. By careful collection of such branches a succession of blooms can be had until the plants bloom naturally outdoors.

Watch for mice around your woody perennials. A small circle around the stem should be kept free from mulch.

Lawn:—The lawn is dormant but can easily be ruined by promiscuous traffic passing over it in winter. A thin mulch of finely ground leaves tends to prevent alternate freezing and thawing on warm days and cold nights of January.

THE WEST COAST

Flower Garden:—Sow seeds of the tender and half-hardy annuals, and especially the small-seeded annuals like petunia, snapdragon, lobelia, and niermbergia. This also is the time to plant the seeds of such plants as aconite, gentian, helleborus, pentstemon which germinate better after being exposed to low temperatures. The seeds of hardy annuals can be sown outdoors where they grow to maturity. Seeds of the alpine plants may also be sown outdoors in January.

African violets like warmth, light but not direct sunlight, and warm water applied through the bottom of the pot. Poinsettias need plenty of water so that a good way to water them is to plunge the pot into a pail of tepid water and then permit it to drain 15 minutes before returning the plant to its ornamental container. Cyclamens prefer a cool room that is well lighted.

Winter bouquets may be made of everlastings that were prepared for the purpose last fall, of flowering shrubs that are brought inside and forced into bloom. For best results recut the base of the branch under water and with a sharp knife rather than with a scissor-type pruner. Even wild plants as currants, cherries, and plums can be forced into winter bloom.

Single tulips may be brought into a warm room now. The double varieties do not force well before February. Oxalis plants potted in the fall should be coming into bloom now. Fuchias may be forced into growth at this time.

January is a good time for pruning roses, as they are most dormant at this time. You should also prune overgrown vines as honeysuckle, trumpet creeper, and jasmine. It is too early to prune fuchia, lantana, heliotrope, geranium, and other half-hardy shrubs.

Shrubs and Trees:—Newly planted shrubs and trees should be watered even though the ground seems damp. This will settle the ground snugly around the roots and close up air pockets. It is also a good plan to stake trees as a precaution against being blown over by winter winds. Tie the tree to three stakes placed at equal distances around the tree and at some distance from it. Fruit trees may be pruned during January. Early blooming heathers and acacias may be pruned as soon as they are out of bloom.

THE SOUTH

January in the South is a month for both planning and planting. The seeds of practically all plants may be sown outdoors this month in the deep South. Even plants of the more hardy kinds may be set out in January.

Flower Garden:—After setting out alyssum, candytuft, stocks, snapdragon, and violas, plant lily bulbs and gladiolus corms among them and broadcast over

the bed some of the early grown annuals as larkspur, poppies, love-in-the-mist, and baby-blue-eyes.

Jerusalem cherry, ardisias, and azaleas may be planted outdoors in the lower South. Azaleas should be pruned back so that they do not bloom this month.

Shrubs and Trees:—January is a good month for rose planting in the South. New bushes should be planted as soon as possible in well-drained, slightly acid soil. Add plenty of compost and you will have healthy plants and large flowers. Established roses should be pruned, except the climbers which should not be pruned until after blooming. Polyanthus and China and old tea roses will not need much pruning. Trees and shrubs can be moved in January while they are dormant. Many of the summer flowering trees will benefit from winter pruning, especially crepe myrtle and althea.

THE DEEP SOUTH

Flower Garden:—One of the most attractive flowers for this section is the flame vine (*Pyrostegia ignea*) whose vivid blooms stand out among the green foliage. This vine lends itself more than most plants to outdoor decoration. It is a rampant grower and needs occasional pruning to secure a profusion of blooms. The volunteer plants that come up from the roots should be removed. If the plants are not properly pruned, vines may extend to twenty-five or thirty feet.

January is a good month to plant the following: ageratum, alyssum, African daisy, aster, babysbreath, bachelors' button, double Camellia-flowered balsam, didiscus, calendula, calliopsis, candytuft, Chinese forget-me-not, Shasta daisy, dianthus, gaillardia, strawflower, hollyhock, larkspur, lupine, nasturtium, pansy, phlox, petunia, Queen Anne's lace, salvia, scabiosa, snapdragon, sweet pea, statice, verbena, and periwinkle.

Vegetable Garden:—Sweet corn planted this month seems to do better than the earlier or later plantings, especially as to comparative freedom from earworms. To combat these many things are used. After experimenting with several substances it has been found that nothing is as good as a few drops of mineral oil or a few moth flakes. The mineral oil recommended for internal use should be used. Most important of all methods is the building up a pest-resistant soil by the generous use of humus. This is especially valuable in raising beans. The freedom from the leaf roller on plants raised on composted soil is really remarkable.

Plant also bush beans, beets, Brussels sprouts, cabbage, Chinese cabbage, cantaloupe, carrots, cauliflower, collard, cucumbers, eggplant, endive, kale, kohl rabi, leek, lettuce, mustard, onion seed, onion sets, parsley, parsnip, peas, peppers, potatoes, radishes, romaine, rutabaga, salsify, spinach, squash, Swiss chard, tomato, turnip and watermelon.

Citrus:—Good news for those who raise home grown oranges and grapefruits is the proven fact that all commercial fertilizers, poison dusts, and sprays may be dispensed with when the plants are grown in richly composted soil.

ORIENTAL POPPY

New leaf growth of the oriental poppy takes place in the fall and winter. To prevent the accumulation of water around the plant, a slight hilling up with soil around the plant is desirable. After the ground freezes, lift the developing leaves and carefully apply a mulch of compost, dried grass, straw, hay, or similar substance around the crown of the plant but care must be taken that the leaves are not covered with the mulch. Since these poppy plants are shallow rooted, they should be hoed very little or not at all in the spring.

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ROSES CAN TOLERATE SHADE

Roses will thrive and bloom also in the more or less shaded parts of the garden. Some varieties may even be grown in deep shade providing the soil conditions are favorable. Even a section cut out of woods has some spot where the sun penetrates at some time during the day, and is a good place to grow rose bushes. Some varieties of roses bloom longer and tend to have a deeper flower color when grown in shade. The flowers will have high quality but may lack the size of exhibition flowers. In woodsy places it is necessary to prune the lowermost branches of the trees so that sufficient light and air are admitted to the roses at all times. The species roses especially will do well in partial shade so long as they get just a few hours of sunshine each day. Among these are blanda, virginiana, and setigera. Also such robust climbing roses as Dr. Van Fleet, Aviateur bleriot, and Breeze Hill can tolerate considerable amounts of shade.

INTERPLANTING LILIES

All except the dwarf lilies should be inter-planted with companion plants which will add color and beauty to the lily bed. Some suggested plants for this purpose are early blue phlox (*Phlox divaricata*), babybreath, sea-lavender, larkspur, heuchera, and gypsophila. In selecting the kinds of plants to be used keep in mind the size of the plant and the color of the flower.

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WINTER PROTECTION

All plants, some more than others, need a certain amount of protection against the winter sun, drying winds, and sudden and often great changes in temperature. Plants with greatly elongated stems, as rambler roses, may be buried in a shallow trench in the soil. Tree roses and almost any plant that is not too large may be laid over and buried in the ground as soon as they become dormant in the fall. Tea roses should have a mound of earth around each plant to protect the bases of the stems. Boxwoods and other plants which need protection should be screened from the wintry winds with burlap or should be enclosed with wooden structures or other materials which do not absorb and hold moisture. All plants are benefitted with a ground mulch of leaves, compost, straw, hay, salt hay, ground-up plant materials, or any material which will insulate the ground and prevent sudden changes in temperature and loss of moisture. When properly mulched the roots of many plants remain more or less active throughout the entire winter. Since the feeder roots of many plants occur near the surface, mulch-

ing is of the greatest importance. In the case of trees, do not put the mulch too close to the stem. To protect the bases of trees from mice and rabbits, place a piece of galvanized wire cloth with a quarter-inch mesh around the stem.

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ANNUALS FOR FALL SEEDING

Many gardeners ask, "Which of the annual flowers may be seeded in the Fall?" As a general rule it may be said that any annual that seeds itself outdoors is a hardy annual and can be seeded in the Fall. The seeds may remain dormant during the winter but will be ready for early germination as soon as the days of spring provide enough warmth. The early spring start will enable the plants to make their growth and bloom before the hot dry days of late summer. Many annuals, as calendula, prefer the cooler and moister months of spring and autumn to summer. Among the hardy annuals are the following:

Argemone	Morning glory
Balsam	Nigella
Calendula	Petunia
Calliopsis	Pinks
Cleome	Portulacca
Cosmos	Snapdragon
Eschscholtzia	Sweet alyssum
Four-o'clock	Sweet pea
Gaillardia	Zinnia
Kochia	

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PLANTAIN LILY

The plantain lily, also commonly known as Hosta and Funkia, prefers partial shade but will tolerate deep shade as well as the full sun. It is easy to transplant and may be left undisturbed for many years. It is best to transplant it in early spring.

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CUTTINGS

Parts of plants cut or otherwise removed from a parent plant and inserted in a rooting medium as sand, peat moss, and water are known as cuttings. They are classified as root-, stem-, rhizome-, or leaf-cuttings according to the part of the plant used. Stem cuttings are called softwood- or hardwood-cuttings depending upon whether the stems used are green and immature or mature and hardened.

Softwood cuttings should be taken from vigorous plants at a stage when it breaks with a snap when bent. If it can be crushed easily between the thumb and forefinger, it is too young to use, while if it bends without breaking it is too old and too hard to serve as a green or softwood cutting. They should be from 2 to 4 inches long, and should be cut straight across the stem just below a node. The top should be cut diagonally with a bud just below the tip. Each cutting should include 3 or 4 nodes. The lower leaves of the cutting should be removed and if the leaves are large, parts of the upper leaves blades should be cut away to prevent excessive loss of water.

Softwood cuttings should be rooted in coarse, clean sand which is free from clay and organic matter. Vermiculture is a good commercial rooting medium.

Hardwood cuttings are used to propagate such plants as grapes, softwooded trees as poplars and willows, and many kinds of shrubs. In the fall when the leaves have fallen and the stems are well matured and hardened, cut twigs of the required length (6 to 10 inches), tie them in bundles of a dozen, and bury them, butt-ends up, in the soil below the frost line. Or they may be buried in sand or peat moss and kept in a cool cellar or cave. By spring these cuttings will have formed good calluses (protective coverings of new cells over the cut surfaces) and will root more quickly and more freely than cuttings newly made in the spring.

Hardwood cuttings may be rooted in a sand-filled flat or rooting bed. Arrange them in rows and pack the sand down firmly between the rows. The time required for roots to form varies with different kinds of plants.

ORGANIC GARDENERS' DIGEST

By DR. WILLIAM H. EYSTER

POISONED VEGETABLES

Celery dusted or sprayed with Bordeau mixture, a fungicide containing salts of copper and lime, caused acute nausea in one case reported to the New Hampshire Department of Health. The department noted that residues from this fungicide are not always washed off by the rain and recommended that in the interest of health all fruits and vegetables be thoroughly washed and, if necessary, scrubbed, to remove all traces of fungicide before serving.

—Consumers' Research Bulletin, May, 1948.

Recently large amounts of arsenic were found in soya sauce shipped into California by a large and well-known Illinois manufacturer of corn products. The arsenic was present in a sufficient amount (3½ to 10 grains per pound) to cause serious poisoning. Many consumers were taken ill, and the cause was at first diagnosed as food poisoning. Upon investigation it was learned that the difficulty arose from use, for processing, of a supply of sodium hydroxide which had been contaminated with arsenic in a manufacturing plant which made a weedkiller containing sodium hydroxide with arsenic.

Arsenic gets into food in many ways, usually not in the drastic and accidental fashion of the case described above. As has often been shown, the almost universal practice of spraying apple and other orchards with some form of lead arsenic to protect the fruit from insects often results in definite and serious contamination of the fruit. The United States Department of Agriculture has become aware of this source of poisons and has issued regulations governing the permissible amounts of lead, arsenic, and other poisonous metals on fruits and vegetables when sold in interstate commerce.

Unfortunately the harmful effects of very low concentrations of arsenic and other poisons are not immediately noticeable and are cumulative. Sometimes the injury does not become evident for years; then suddenly will occur disastrous and lasting illnesses or mental breakdowns of one sort or another. In one expert's opinion, about one-third of eczema cases were arsenical poisoning or complications of it. Arsenic is also known to produce skin cancers.

(Editor's note:—Since it is difficult to remove all traces of poisonous sprays and since copper salts are toxic in extremely dilute solutions, it might be better to follow cultural practices in growing vegetables which do not require the use of poisonous sprays.)

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BIOLOGICAL CONTROL OF JAPANESE BEETLES

The customary method of application of the "milky" disease spore dust of Japanese beetle grubs is to spot the material at three- to five-foot intervals

in rows three to five feet apart, using a level teaspoonful of the spore dust per spot. The spore dust may also be mixed with loam, sand, or lime and spread evenly over the surface of the ground by hand or by means of a hand- or tractor-drawn lime distributor at the rate of one pound of spore dust to 4,000 square feet of turf. It is best to make the application immediately before a rain so that the dust is washed into the soil. For best results, early fall application is preferred. Under most conditions three or more years seem necessary for the "milky" disease to become effective.

Among the natural enemies of the Japanese beetle are a number of insect parasites native to Japan and Korea which have been successfully established in various parts of the area of continuous beetle infestation in the United States. *Tiphia vernalis* and *T. popilliavora* are wasp-like parasites which attack the grubs in the soil. Another introduced species of insect, *Centeter cinerea,* resembles our common house fly and is parasitic on adult Japanese beetles. At the present time the distribution of insect parasites of the beetle is being handled only by Federal and State agencies.

—Circular 166, Connecticut Agricultural Exp. Sta., May, 1948.

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CALCIUM ARSENATE KILLS BEES

Two colonies of bees were placed at one end of a 320-acre cotton field to be dusted with 15 per cent calcium arsenate at the rate of 20 pounds per acre. Each hive had top ventilation. The entrance to one hive was left open while that of the other was closed with screen wire. Dusting was done in such a way that the colonies were in line of the maximum drift of the dust. After the dust cloud had completely disappeared from the field, the closed hive was returned to its home location 15 miles away, and the entrance opened. The colony was observed for several months but at no time were any effects noted of exposure to the drifting dust.

A second application of the same type of dust was similarly applied seven days later. The colony in which the bees were free to fly was left in the dusted area for ten days. At the end of that time the colony strength was reduced at least by half. The colony was then returned to home location, where it weakened rapidly. All the bees were dead 38 days after first exposure to the dust. The test proved that the drifting dust does not cause damage, but that death is caused by the bees getting the poison in the field and bringing it to the hive. Analyses showed that the bees, larvae, and pollen were contaminated with arsenic, although there was relatively little in the pollen.

—Technical Bulletin No. 114, Univ. of Arizona. Oct. 1947.

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NITROGEN RELEASED THROUGH ORGANIC MATTER

Apple growers frequently get too much nitrogen in their soil but as often have too little organic matter in the soil. Recently Roy Larsen of Leavenworth emphasized the fact to growers that they cannot get too much organic matter into the soil. He also stressed the value of supplying nitrogen gradually through the use of organic matter. Gradual release of nitrogen is a critical factor in feeding trees, and the water holding capacity of the soil is another. Even though nitrogen tends to accumulate in the soil some growers use as much as 15 to 25 pounds of nitrogenous fertilizer per acre. Mr. Larsen feels that such heavy applications of commercial fertilizers are responsible for a great deal of winter injury and a serious reduction of the good coloring that is so desirable in the fruit.

—The Annapolis Valley Post Road, Nova Scotia, June, 1948.

The Soil and Health Foundation

Garden Contributions for the Soil and Health Foundation

The Soil and Health Foundation is now supporting an experiment concerned with nutritional value of wheat grown in soils fertilized with organic and artificial commercial fertilizers respectively. For this, healthy and cancerous strains of white mice are being used. One purpose is to make observations on the relation of foods to the incidence of cancer. Also a laboratory on the organic farm has been built and is ready for equipment and a biochemist to make fundamental studies on soils and the nutritional values of foods. Contributions are now being received to purchase equipment and pay the salary of the biochemist.

The Foundation already has more than 700 associate members who have made one or more contributions. As other sources of income, members have suggested donations from garden clubs and from the sale of excess flowers and vegetables from private gardens, as indicated in letters like the following:

November 27, 1948

Gentlemen:

A thought occurred to me while reading about the need of funds for the Soil and Health Foundation in the November issue of the *Organic Gardening* magazine. I suggest that each subscriber of the magazine set aside a portion of his garden next year for the benefit of the Foundation. All moneys received from the sale of vegetables, fruits, bouquets of flowers, plants or other nursery stock then be sent to the Foundation. Even if the allotted plot earned as little as fifty cents, a goodly sum could be raised for the Foundation if enough gardeners cooperate. The satisfaction each one of us would derive from doing something worthwhile for a good cause would be great! You may look for mine this coming year.

A. L. Wakefield,
Otsego, Michigan.

All contributions should be sent to the Secretary of the Soil and Health Foundation, 46 South West St., Allentown, Pa.

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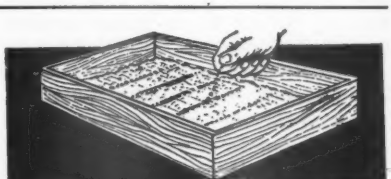

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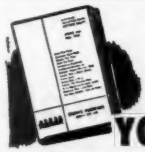
WILD FLOWER GUIDE by Edgar T. Wherry, Ph. D., (Doubleday & Company, Inc., Garden City, New York. 1948 $3.00).

Dr. Wherry's Wild Flower Guide is at once a scientifically accurate textbook and a handbook for the field which is easy to understand and follow. There are 105 plates, each illustrating characteristics for the easy identification of flowers in the field. There are approximately 200 plants illustrated in colors. The illustrations blend neatly with the text so that it is a simple matter to quickly identify any wild flower you may find. For each plant are given the scientific name, common name, its habitat, its range, and suggestions for cultivating it. Emphasis is placed upon floral symmetry and the evolutional history of the plant. The plants are first grouped into families, then the characteristics of each of the species are summarized. The book includes an appendix which classifies the flower according to color, and one which deals with wild flowers introduced from other countries.

ROAD TO SURVIVAL by William Vogt. (William Sloane Associates, Inc., Publishers, 119 West 57th St., New York 19, New York. 1948 $4.00)

The earth has suffered at the hands of man to such an extent that he must think seriously of his ability to survive. The earth as abused by man is no longer able to provide the human race with foods that make possible both health and happiness.

The natural resources of the earth have long been taken for granted, but now we are being faced with the depletion of our most valuable resources:—water and soil. The falling productivity of the soil and the increasing human population concern all humanity. Road to Survival should be read and understood by all intelligent citizens. This book deals with the inescapable facts of the earth. Man's present cultural practices are suicidal. It is high time that measures be adopted which will conserve what good soil is left and takes steps to reclaim the millions of acres which have already been rendered almost worthless agriculturally. The 335 page book has an index and references to source materials.



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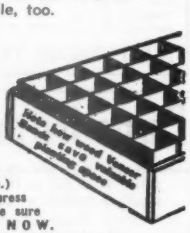

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Compost Clinic . . .

GRINDING HASTENS COMPOSTING FERMENTATIONS

In this clinic we have been discussing various details concerned with the proper building of a compost heap and the making of well-fermented compost rich in plant nutrients. Invariably one of the objections to the making of compost on the part of the farmer and gardener is the time required. Recent experience has shown that reducing the plant materials to fine particles before putting them in the compost heap hastens the rate of decomposition and shortens the time required beyond all expectations. With finely ground plant materials, properly built heap, and inoculum of highly selected bacteria, finished compost can be made in less time than heretofore if all the conditions necessary for the active growth of the soil organisms are kept favorable. Winter composting can be facilitated by digging the pit into the ground and insulating the top by a suitable covering of such plant materials as leaves.

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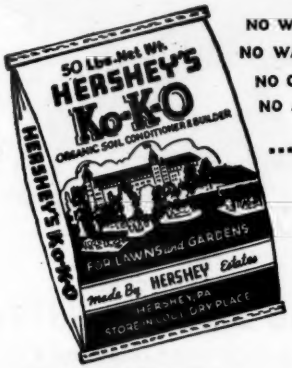

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ume of the fine particles that makes it possible to make finished compost in so short a time as from three to five days. The same principle applies to the burning of such a substance as charcoal. A large piece of charcoal may burn for hours or even days. If the piece of charcoal is reduced to a fine dust, complete combustion will be accomplished in a fraction of a second with explosive force. The compost made in less time than one week will be even better than that made over a period of months, because there is less time for the dissipation of valuable gases and the leaching out of essential elements.

Compost Correspondence

PEAT COMPOST FOR CAMELLIA

Q. Wanting to improve several camellia plants we recently transferred them from the ground to tubs and in the process mixed with peat moss some compost which had been in process about a year. Several weeks later some of the foliage appeared to be stinted in growth and a whitish film appeared on the top of the soil. An expert camellia grower, with whom we consult frequently, surmised that the lime in the compost had not fully disintegrated, advised against the use of such compost for camellia, but suggested the use of cotton seed meal as a substitute for lime for any future

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compost intended for camellias. Do you believe the cotton seed meal would be a proper substitute in such a case, or that it would be satisfactory for any compost?

J. E. H., Glendale, Calif.

A. Camellias are distinctly acid-loving plants and should be fertilized with *peat compost.* This is made by substituting peat for soil in the compost heap and OMITTING LIME. Peat compost should be used for camellia, rhododendron, azalea, blueberry, and other acid-loving plants. These plants can be memorized most easily by forming a word from the first letter of each word, as CRAB. Acid loving vegetables are sweet potato, watermelon, eggplant, potato, tomato, and others. These can be recalled by the word SWEPT. Many of the perennial herbs and most shrubs and trees are acid-loving plants.

—o—

AMOUNT OF COMPOST

Q. I would like to know how much compost should be applied to flowers, shrubs, small fruits, and large fruit trees.

Dr. F. G. H., Madison, Wis.

A. Compost cannot easily be used in excess. I suggest that you use it as freely as your supply will permit, and in proportion to the size of the plants and in accordance with their importance to you.

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—o—

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fruit trees, and how to prevent weeds from growing between the rocks.

Dr. F. G. H. M., Madison, Wisc.

A. Stones rather than rocks should be used. Flat stones of different sizes which do not exceed 4 to 6 inches in thickness and from ½ to 1½ feet square surface are desirable, but stones of any sizes can be used. By laying the stones together closely as in a stone walk or tile floor, the space between the stones can be reduced to a minimum. If the soil beneath the stone mulch is well composted, weeds can be pulled out with little difficulty.

—o—

MICE IN THE GARDEN

Q. For the past two years I have had a lot of trouble with mice in the garden. They eat holes in the side of cantaloupes and eat all the seeds inside. They also eat ripe tomatoes. I have used poison grain and have set traps but all in vain. Can you tell me how to get rid of the mice in the garden?

M. T., Elmira, N. Y.

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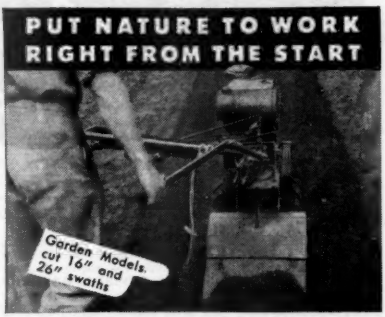

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"THERE IS SOMETHING ABOUT MOUNTAINS that seems to make human beings strong. Something about life in the mountains that puts extra vitality in people. Mountaineers from the dawn of history have been fighters. Why? Because it is so difficult to extract a living from the rocks and crags, the Highlands of Scotland, the mountains of Transylvania, the high plateaus of the Caucasus? That isn't the full explanation. I wonder if the minerals in the mountain soil have anything to do with it.

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"The Hunzas of Far Kashmir claim to be descended from three soldiers of Alexander the Great who lost their way among the gorges and towering peaks of the Himalayas. They live in a real Shangri-La, a gorge surrounded by mountains that average over 20,000 feet in height, and surrounded by some of the largest glaciers on earth outside the Arctic and Antarctic. According to the Englishman, Sir Robert McCarrison, and the American,

J. I. RODALE, who has just written a book about them, entitled
THE HEALTHY HUNZAS

they are THE HEALTHIEST PEOPLE ON EARTH; also just about the most amiable, and, they live in an atmosphere of peace. They have nervous systems of unusual stability. And they live to a great age. **Dyspepsia, appendicitis, colitis, cancer, and many other ailments so common among civilized people, apparently are unknown to them.**

"One of the greatest explorers of our time, Sir Aurel Stein, says that they don't seem to know the meaning of the word 'tired', and that they bathe in a glacier-fed river, in mid-winter, as casually as we step into a tepid bath. The American author J. I. Rodale, who is an expert on organic gardening, believes that the Hunzas are the healthiest people in the world for a number of reasons such as: the vigorous life they lead, the fact that they are abstemious, reared in the natural way as tiny infants; but more than anything else, because they eat what he calls the 'unsophisticated foods of nature.'

"Rodale goes on to say that 'farming is much more important to the health and prosperity' of those of us who live in cities than we realize. That 'not only our health, but our character, our intelligence, our relations with one another' are governed largely by what we eat. He believes that many of the great civilizations of the past, disappeared partly because the people exhausted the fertility of their soils. He recommends that we study the Hunzas of Far Kashmir and find out why they have such marvelous health."

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